Responder™ 2000

defibrillator/monitor

Service Manual

2025653-048 Revision B
Applies to Version 2.22 Software

Revision History

The revision letter identifies the document's update level and changes with every update of the manual.

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2025653-048A	10/2006	Initial Release
2025653-048B	10/2007	Updated LCD cable routing picture; Updated from version 2.12 software to version 2.22; Added safety information for Hellige test lamp; Added Service Sticker orderable part number

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SECTION 1: Introduction

Overview

This Service manual provides information needed to service the Responder™ 2000. This manual should only be used by technical personnel trained to service the Responder 2000.

This chapter contains general information for servicing the Responder 2000.

This Service manual assumes familiarity with the controls and basic operation of the Responder 2000. Detailed information regarding controls, operation, set-up, and regular maintenance procedures are found in the Operator's manual. If necessary, review the Operator's Manual before servicing the Responder 2000.

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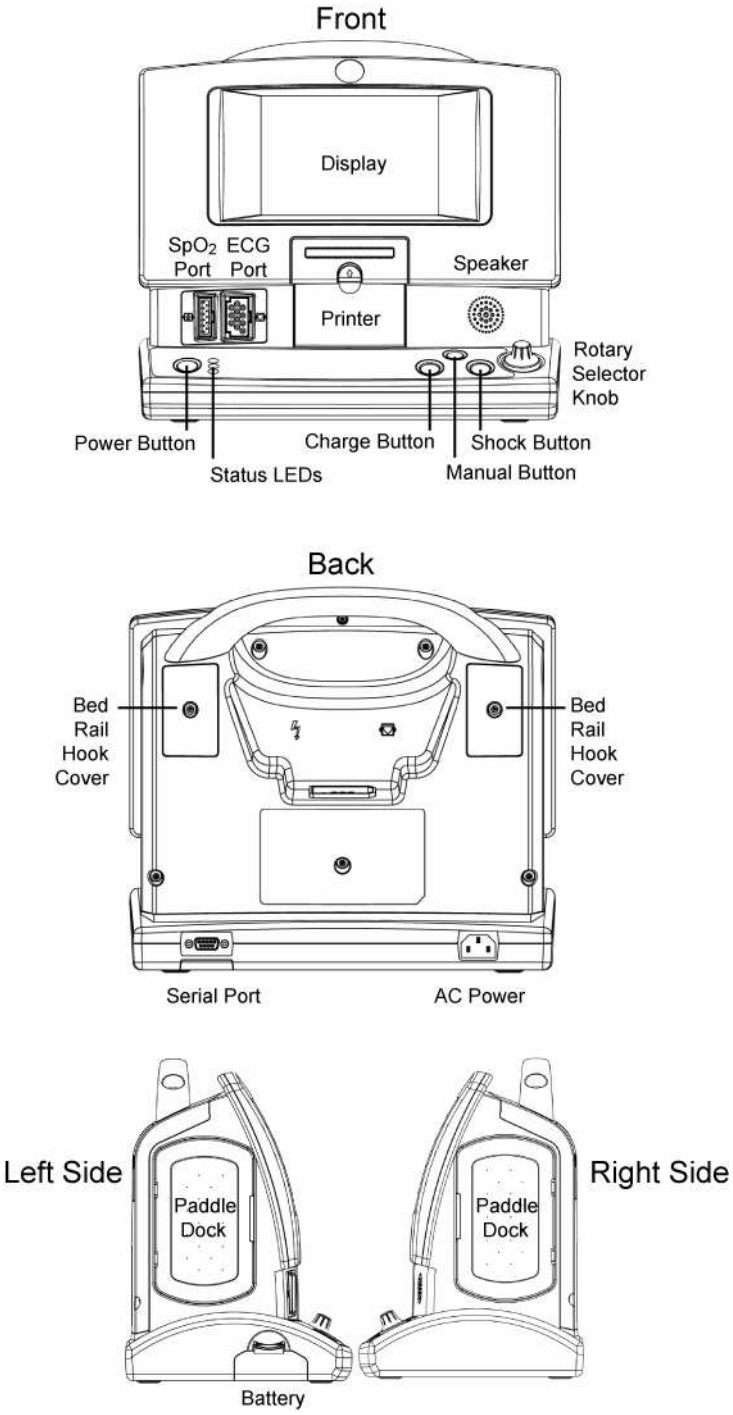
Controls and Indicators	10
General Service Information	11

Description

The Responder 2000 is a defibrillator/monitor/pacemaker intended for use by personnel trained in its operation. The device is lightweight, portable, easy to use and reliable. It incorporates a 320 x 240 transmissive color TFT color display for wide viewing angles in all light conditions. The device operates using either an AC power supply or internal rechargeable Li-Ion battery. The device provides continuous ECG monitoring and three types of therapies: defibrillation, cardioversion and external pacing. Defibrillation can be applied manually or semi-automatically. Pacing therapy can be either fixed or demand. The device employs patented RHYTHMx® software which provides ECG rhythm analysis. STAR® Biphasic waveform delivers impedance-compensated energy ranging from 2-270 Joules. Features and options include external paddles, spoons, disposable pads, 3- and 5-lead ECG, pulse oximetry (SpO2), built-in 60 mm thermal printer, internal storage of event history and remote synchronization to bedside monitor.

Controls and Indicators



General Service Information

Refer to the Operator's Manual for setup (and configuration options) required before placing the Responder 2000 into service.

Navigation

Use the Rotary Selection knob to navigate the Responder 2000 user interface. The Rotary Selection knob is used for:

- Scrolling through menus and sub-menus
- Selecting soft keys
- Setting values

Passwords

The default service password is "HEART1". See the note under Maintenance Mode Tests in Section 5 (on page 54) for detailed password instructions.

Battery Maintenance

The Responder 2000 has a rechargeable battery requiring periodic calibration. Calibration consists of a full charge, full discharge, and full charge of the battery. The cycle may take up to 20 hours to complete.

To calibrate the battery using the optional external charger:

1. Insert the battery into the external charger.
2. Press the calibration button on the battery. The Mode light turns red to indicate calibration in progress.

   To stop calibration, press the calibration button again. The Mode light turns green and the battery begins to charge.

To calibrate the battery without the external charger:

1. Insert the battery into the Responder 2000.
2. Plug the Responder 2000 into an AC outlet.
3. Allow the battery to fully charge.
4. Disconnect the AC power cord and leave on the Responder 2000 until the battery is fully discharged (full discharge takes about four hours).
5. Reconnect the AC power cord and allow the battery to fully charge.

SECTION 2: Maintenance

Overview

Use the following procedures to upgrade the Responder 2000 software:

- Upgrade Software to update one or more software files
- Upgrade Printer Software to upgrade printer software and fonts

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Update Serial and Model Numbers	17

Equipment Setup

Required Tools

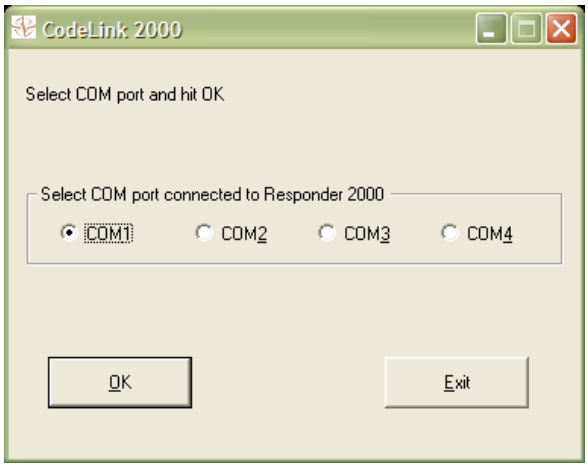
- Serial Cable
- PC (Windows 2000 or XP)

Procedure

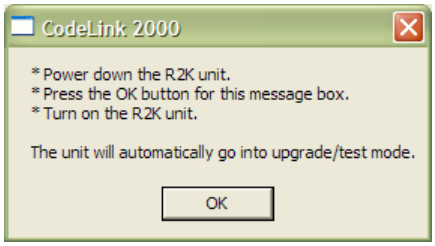
1. Plug AC power cord.

   Note: When performing a software upgrade, the Responder 2000 must be running on AC power.

2. Connect serial cable between the communications port of the PC and the serial port of the Responder 2000.
3. At the desktop on the PC, double-click the Responder 2000 Upgrade icon to open the CodeLink 2000 program.
4. Select the appropriate Com port and click **OK**.



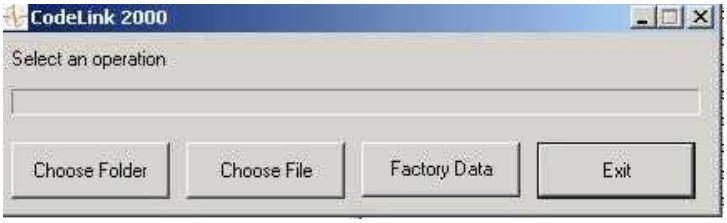
5. Complete the following on-screen instructions and click **OK**.


CodeLink 2000
* Power down the R2K unit.
* Press the OK button for this message box.
* Turn on the R2K unit.
The unit will automatically go into upgrade/test mode.
OK

Upgrade Software

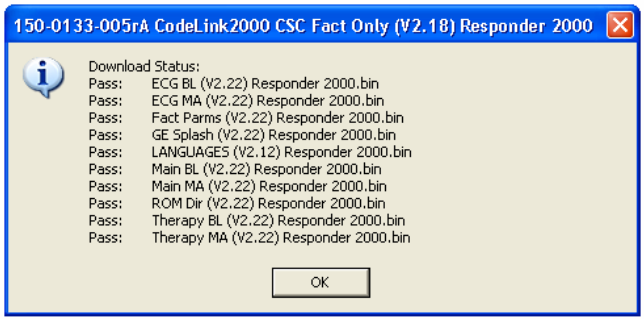
Caution: Procedure Failure
Do not use this procedure to update the printer files. Updating the printer files incorrectly may cause the printer to fail. Use the **Upgrade Printer Software** procedure on page 16.

1. Perform the **Equipment Setup** procedure starting on page 13 until the CodeLink 2000 selection window is displayed:



2. Click **Choose folder** to select all the update files in a folder or **Choose file** to select a single update file.
3. Browse to the folder (or file) to be uploaded and click **OK** (or **Open**). While the files are updating, the status of each file is displayed.

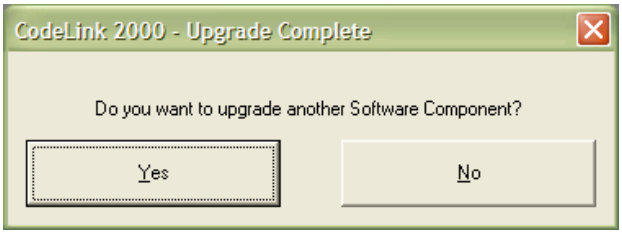
   As the files are updated, the Shock button and then the Manual button flash on the Responder 2000. When all files are updated, a confirmation screen is displayed


150-0133-005rA CodeLink2000 CSC Fact Only (V2.18) Responder 2000
Download Status:
Pass: ECG BL (V2.22) Responder 2000.bin
Pass: ECG MA (V2.22) Responder 2000.bin
Pass: Fact Parms (V2.22) Responder 2000.bin
Pass: GE Splash (V2.22) Responder 2000.bin
Pass: LANGUAGES (V2.12) Responder 2000.bin
Pass: Main BL (V2.22) Responder 2000.bin
Pass: Main MA (V2.22) Responder 2000.bin
Pass: ROM Dir (V2.22) Responder 2000.bin
Pass: Therapy BL (V2.22) Responder 2000.bin
Pass: Therapy MA (V2.22) Responder 2000.bin
OK

4. Verify Pass is displayed for each file and click **OK**.

   Note: If a file fails to update, retry updating the file individually.

   The Upgrade Complete Notification is displayed:



5. Click **Yes** to upgrade more files (and repeat this procedure from step 2) or **No** to exit.

6. Click **Exit**.
7. Verify the file upgrade on the Responder 2000.
   A text file with the software version numbers is included with the upgrade folder. Compare those software version numbers to the versions listed on the Responder 2000.
   a. Press and hold the **Power** button for 5 seconds to reboot the Responder 2000.
   b. Highlight and click the **System** Menu.
   c. Click **About**.
   d. Click **Next** to scroll through the version screens. Verify all software versions are updated as listed in the Version.txt file.

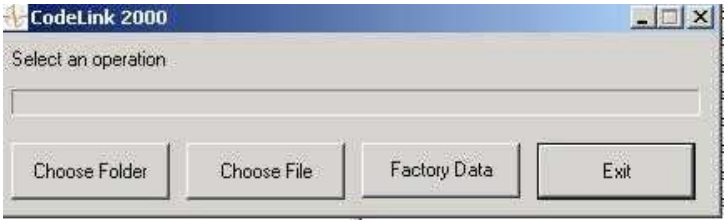
Upgrade Printer Software

When installing the printer software, the files must be upgraded in the following order without reboot:

- printerflash.bin
- printerfont.bin
- printerflash.bin again

Caution: Procedure Failure.
The printer files must be updated without reboot. If the unit is rebooted during the installation, the printer may not work (the Main Board firmware must then be reinstalled at a repair center).

1. Perform the Equipment Setup procedure starting on page 13 until the CodeLink 2000 selection window is displayed:



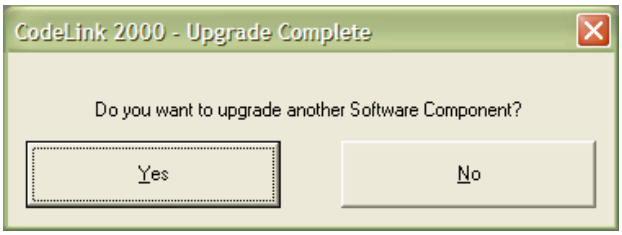
2. Click **Choose file** to select a single update file.
3. Navigate to the **Printer** folder and select the **printerflash.bin** file.
4. Click **Open**. While the file is updating, the status of the file is displayed.

   As the file is updated, the **Shock** button and then the **Manual** button flash on the Responder 2000.

5. When the file is updated, a confirmation screen is displayed:
6. **Verify Pass** is displayed for the file and click **OK**.

   Note: If the file fails to update, try updating the file again.

   The Upgrade Complete Notification is displayed:

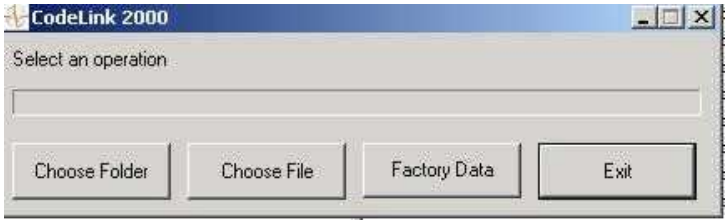


7. Click **Yes** and repeat this procedure for the **printerfont.bin** file and then the **printerflash.bin** again.
8. Click **Exit**.
9. Verify the file upgrade on the Responder 2000.
   a. Press and hold the Power button for 5 seconds to reboot the Responder 2000.
   b. Highlight and click the System Menu.
   c. Click About.
   d. Click Next to scroll through to the printer version screen. Verify the Printer and Font software versions are updated as listed in the Version.txt file.

Update Serial and Model Numbers

When replacing the Main Board, the Serial and Model numbers must be updated.

1. Before replacing the **Main Board**, record the Serial and Model numbers from the **About** screen.
   Note: If the Responder 2000 cannot be booted, record the model and serial number from the back panel label.
2. Replace the **Main Board**.
3. Perform the **Equipment Setup** procedure starting on page 13 until the CodeLink 2000 selection window is displayed:



4. Click **Update Factory Data** and enter the previously model and serial numbers.

   Note: If the **Main Board** is not replaced, the fields are not editable.

5. Click **OK** to accept.

SECTION 3: Troubleshooting

Overview

This section describes how to troubleshoot the Responder 2000. These instructions are intended for use only by service providers who are specifically trained to service the Responder 2000.

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Repair Tools and Equipment	20
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Safety Precautions

WARNING: Shock Hazard
The Responder 2000 is designed to deliver high-voltage therapeutic shock. Before performing any service on the equipment, read and follow all safety precautions and instructions in the Operator's Manual.

WARNING: Shock Hazard or Equipment Damage
Before servicing the Responder 2000, disconnect the AC power cord and remove the battery.

WARNING: Shock Hazard or Equipment Damage
Internal components of the Responder 2000 may still contain high voltages even after the AC power cord and battery are removed. Before working on any internal component, verify high voltages are not present.

WARNING: Shock Hazard or Equipment Damage
Some service activities require the Responder 2000 to be energized with covers removed. Ensure all personnel and equipment is clear while the equipment is energized.

WARNING: Biological Contamination
During normal operation, the Responder 2000 may be contaminated by blood, body fluids, or other biological agents. Always assume the Responder 2000 is contaminated and use appropriate safety procedures until decontamination is performed. Always decontaminate the Responder 2000 in accordance with hospital or facility procedures before servicing or returning to service. Refer to the Responder 2000 Operator's Manual for recommended cleaning agents and instructions

Caution: Electrostatic Damage
Always use a wrist grounding strap and anti-static mat while performing service on any internal components.

Caution: Voiding Product Warranty
Any service performed on the Responder 2000 must be provided by authorized service representatives only. Unauthorized repair voids the product warranty.

Who Should Perform Repairs

Repair and service of the Responder 2000 must be performed by qualified service technicians trained in safe and proper servicing of the Responder 2000.

Service/Replacement Parts

For service, please contact your local GE agency. For additional information, please visit our Web site at: http//www.gehealthcare.com.

Please have the serial and model numbers available when contacting Customer Service. (The serial and model numbers are located on the back (and on the inside) of the Responder 2000.)

Disposal

Always dispose of the Responder 2000, any unserviceable parts or accessories, or batteries in accordance with any local disposal regulations for equipment containing electronic parts. Note the following precautions:

WARNING: Shock Hazard
Disposal of the Responder 2000 with the battery inserted presents a potential shock hazard.

WARNING: Environmental Contamination
Disinfect the Responder 2000 appropriately prior to disposal. Also recycle or dispose of the lithium-ion battery in accordance with applicable local regulations.

WARNING: Fire or explosion hazard
Do not burn or incinerate the battery. Recycle or dispose of the lithium-ion battery in accordance with applicable local regulations.

Caution: Environmental Contamination
Dispose of the pads or electrodes in accordance with any local disposal regulations.

Repair Tools and Equipment

The following tools are needed to perform the procedures in this section.

- TR15 Safety Torx
- TR25 Safety Torx
- Serial cable for software upgrades (with Windows 2000 or XP PC)
- Software upgrade kit

Troubleshooting Guide

General Troubleshooting

Before performing any troubleshooting, check the following:

Ensure all external cables and connections are tight and undamaged.

- If possible, ensure the unit is plugged in to a receptacle with appropriate voltage available (see SECTION 8: Specifications and Safety for voltage requirements). If no receptacle is available, use a known good, charged battery to perform any tests.
- Visually inspect the unit for any obvious external damage, including cracks in the display, case, or connectors.
- Ensure all connector pins and sockets are clean, free of debris, and intact.
- Discuss the issues with the operator:
    - Have the operator explain and demonstrate the problem.
    - Ask about any previous repairs or problems.
    - Has the unit been stressed (including extreme heat/cold, submersion, falls, etc.)?

No Boot

Use this procedure to troubleshoot the Responder 2000 when plugged into an AC outlet. For battery troubleshooting, including an operation failure while using the battery, see “Battery Troubleshooting”.

A. If the AC Power LED is not lit

1. Verify power at the AC outlet.
2. Verify AC power available from the AC power cord.
3. Replace power supply.
4. Replace the **Power Control Board**.

B. If the AC Power LED is lit

1. Check **Power** button for mechanical operation.
2. Check cables from **Power Control Board** to **Main Board**.
3. Ensure cables are properly seated, tight, and undamaged.
4. Replace **Power Control Board**.
5. Replace **Main Board**.

Boot, but no Response

Use this procedure to troubleshoot the Responder 2000 when the unit seems to boot up normally (i.e., the Front Panel LEDs flash and a speaker tone is heard when the Power button is pressed), but does not respond to any subsequent user input.

A. If the ECG trace is not moving

1. Replace the **Main Board**.

B. The Rotary Selection knob works properly

1. Check buttons for mechanical operation.
2. Check cables from **Power Control Board** to **Main Board**.
   Ensure cables are properly seated, tight, and undamaged.
3. Replace **Power Control Board**.
4. Replace **Main Board**.

C. The Rotary Selection knob does not work properly

1. Replace **Rotary Selection knob**.

   Note: The figure below shows the area where the Rotary Selection knob cable can be easily damaged if flexed several times or otherwise stressed.

2. Check cables from **Power Control Board** to **Main Board**.
   Ensure cables are properly seated, tight, and undamaged.
3. Replace **Power Control Board**.
4. Replace **Main Board**.

Bad Front Panel LEDs

Use this procedure to troubleshoot the Responder 2000 when the **Front Panel** LEDs are not displaying correctly. Normal operation is indicated by:

At system boot, all LEDs will flash.
Green AC Power LED is lit when the unit is plugged in.
Yellow Battery Charging LED is lit when the battery is lit when the unit is plugged in and a discharged battery is inserted.
Red Service Required LED should be off.
Blue Manual button LED is lit.

1. Ensure the unit is plugged in and receiving power from the wall outlet.
2. If the battery charge LED is not lit when a battery is inserted, replace the battery with a known good battery.
3. Check cables from **Power Control Board** to **Main Board**.
4. Ensure cables are properly seated, tight, and undamaged.
5. Replace **Power Control Board**.
6. Replace **Main Board**.

Buttons do not Work

A. The Rotary Selection knob does not work properly

1. Replace Rotary Selection knob.

   Note: The figure below shows the area where the Rotary Selection knob cable can be easily damaged if flexed several times or otherwise stressed.

2. Check cables from **Power Control Board** to **Main Board**.
3. Ensure cables are properly seated, tight, and undamaged.
4. Replace **Power Control Board**.
5. Replace **Main Board**.

B. The Rotary Selection knob works properly

Perform Button Tests (refer to the Button Test procedure on page 54).

If *Manual, Charge, Shock* fails:

1. Check cables from **Power Control Board** to **Main Board**.
2. Ensure cables are properly seated, tight, and undamaged.
3. Replace **Power Control Board**.
4. Replace **Main Board**.

If *Paddles, Charge, Shock* fails:

1. Replace paddles.
2. Check cable from rear connector to **Therapy Board**.
3. Check cable between **Therapy Board** and **Main Board**.
4. Replace **Therapy Board**.
5. Replace **Main Board**.

Bad Speaker

Use this procedure to troubleshoot the Responder 2000 when the **Speaker** is not working correctly.

Note: The Speaker cannot be removed from the Front Panel. If the speaker must be replaced, the entire Front Panel must be replaced.

Normal operation is indicated by:

At system boot, the speaker sounds a brief tone (listen carefully because the tone is easy to miss in a noisy environment). When audio indication is enabled in the *Settings* menu, the speaker should emit loud, non-distorted tones.

1. Check speaker plug and cable.
2. Check speaker resistance. It should be between 4 and 10 ohms.
3. Replace **Front Panel**.
4. Replace **Main Board**.

Display is Dim, Dark, Fuzzy, or Unreadable

Normal operation is indicated by:

At system boot, all LEDs will flash.
The speaker sounds a brief tone (listen carefully because the tone is easy to miss in a noisy environment).
Green **AC Power** LED is lit when the unit is plugged in.
Yellow **Battery Charging** LED is lit when the unit is plugged in and a partially or fully discharged battery is inserted.
Red **Service Required** LED should be off.
Blue **Manual** button LED is lit.

A. If the Display is Dim

1. Check the software setting for display brightness.
2. Check the backlight cable
3. Run display test from the Maintenance menu to verify the display is working and there are no bad pixels.

   If these checks are ok, continue with the following steps.

B. If the Display is Dark, Fuzzy, or Unreadable

1. Check the display cable.
2. Replace the **Display**.
3. Replace the **Main Board**.

Printing Problems

Note: Check the paper roll to ensure the customer is using approved paper listed in the Accessories list. Non-approved or generic paper may cause printer damage or failure.

1. Ensure paper roll is in good condition (dry and undamaged).
2. Ensure paper is loaded correctly
3. If the *Print* icon is not selectable, ensure the printer door is fully closed and the paper is properly inserted.
4. Replace the printer door.
5. Check printer cables.
6. Replace printer.
7. Replace **Main Board**.

After troubleshooting, always print a test strip (page 55) to ensure proper operation.

Battery Troubleshooting

Check battery statistics. Good batteries have a capacity of at least 4500 mAH and will be charging when the Responder 2000 is plugged into an AC outlet.

1. Ensure battery is fully charged.
2. Perform Battery Calibration on page11.
3. Replace the **Battery**.
4. Replace **Power Control Board**.
5. Replace **Main Board**.

SpO_2 Not Working

Verify the Responder 2000 has a SpO_2 **Main Board** installed.

Check the *About* screen. "*SpO2 - - - -*" indicates a non-SpO_2 **Main Board** is installed in the unit.

1. Connect the Responder 2000 to a SpO_2 simulator with the appropriate sensor.
   If the Responder 2000 SpO_2 display does not agree with the simulator setting, substitute a known good SpO_2 sensor.
2. Check SPO_2 cable.
3. Check cable from **Front Panel** to **SPO_2 Board**.
4. Replace **SPO_2 Board**.
5. Replace **Main Board**.

Shock into Paddle Dock Fails

If shocking into the paddle dock does not work or shows high impedance.

Perform a button test for each Paddle.

- If the test fails, replace the Paddle.
- If the test does not fail, connect the Paddles to a simulator and attempt to shock.

If the shock is successful:

1. Check the cables from the **Therapy Board** to the paddle dock (one on each side).
2. Replace the **Therapy Board**.

If the shock is unsuccessful:

1. Ensure the paddles are securely paced in the paddle dock.
2. Replace the Paddles.
3. Check the cables between the **Rear Panel** and the **Therapy Board**.
4. Check the cable between the **Therapy Board** and the **Main Board**.
5. Replace the **Therapy Board**.
6. Replace the **Main Board**.

Shock into Patient Fails

1. Perform a button test for each Paddle.

   If the test fails, replace the Paddle.

   If the test does not fail, connect the Paddles/Pads/Spoons to a simulator and attempt to shock.

2. If the shock is successful:

   The unit is working correctly. Check patient preparation.

3. If the shock is unsuccessful:
   1. Replace the Paddles/Pads/Spoons.
   2. Check the cables between the **Rear Panel** and the **Therapy Board**.
   3. Check the cable between the **Therapy Board** and the **Main Board**.
   4. Replace the **Therapy Board**.
   5. Replace the **Main Board**.

No ECG from Paddles/Pads/Spoons

1. Replace the paddles/pads/spoons.
2. Check the cables between the **Rear Panel** and the **Therapy Board**.
3. Check the cable between the **Therapy Board** and the **Main Board**.
4. Replace the **Therapy Board**.
5. Replace the **Main Board**.

Service Required LED is ON

If the Service Required LED is on and the fault has been corrected, perform this procedure to clear the fault.

1. Go to *Maintenance* > *Stored Data Management* > *Clear Service Required Indicator*.
2. Press *Accept*.
3. Cycle power.

   If the fault does not clear, go to *History* > *Event Log* to find the fault log entry.

Note: All service required Error codes are displayed in the History with a red exclamation mark.

SECTION 4: Repair

Overview

This section describes how to assemble and disassemble the Responder 2000. These instructions are intended for use only by service providers who are specifically trained to service the Responder 2000.

This section is divided into two parts:

How to Replace Specific Components: Provides high-level disassembly steps with references to the assembly steps.

Assembly: Lists production assembly steps applicable to field repair.

TOPIC	PAGE
Required Tools	27
Disassembly Overview	27
How to Replace Specific Components	28
Assembly	31

Required Tools

The following tools are necessary to Assembly/ Disassembly the Responder 2000.

Note: The Security Torx is also known as Tamper Resistant Torx.

T15 Security Torx driver
T25 Security Torx driver
Philips Screwdriver
Tube of Silicone

Disassembly Overview

WARNING: Lethal Shock Hazard.
In the event of equipment failure, the two main capacitors may retain dangerous voltages even if the Responder 2000 is disconnected from AC power and the battery is removed. Normally, the capacitors are discharged when power is shut off; however, it is possible for equipment damage to prevent the capacitors from discharging properly.

Always assume the capacitors are fully charged.

Caution: Shock Hazard or Equipment Damage.
Before opening the case, ensure the AC power cord is disconnected and the battery is removed.

Caution: Equipment Damage.
Always wear a grounding wrist strap and use an anti-static mat when handling parts.

Caution: Procedure Failure.
Even though some assembly steps may not be applicable to a specific replacement procedure, all other steps must be performed in the order listed.

The Responder 2000 has two access points:

Rear Cover: Provides access to **Capacitors**, **Therapy Board**, optional **SPO2 Board**, and **ECG Board**, and **Front Bezel**. Removing the Bezel allows access to the **Main Board**, **Printer**, and **Display**.
Base Cover: Provides access to the **Power Supply**, **Power Control Board**, **Fan**, and **Switches**.

Note: The Speaker is part of the Front Body Assembly.

How to Replace Specific Components

Use the following procedures as a guide to replace specific internal components in the Responder 2000. Not all components are listed. (For example, if the **Front Body** is damaged and must be replaced, the entire unit must be disassembled and then reassembled using the more detailed Assembly instructions).

Capacitors (see page 46)

WARNING: Lethal Shock Hazard.
In the event of equipment failure, the two main capacitors may retain dangerous voltages even if the Responder 2000 is disconnected from AC power and the battery is removed. Normally, the capacitors are discharged when power is shut off; however, it is possible for equipment damage to prevent the capacitors from discharging properly.

Always assume the capacitors are fully charged.

1. Remove **Rear Cover** *(see Figure 67: Rear Body Installed)*.

   Note: Two cover screws are located under the Bed Hook Covers.

2. Cut tie wraps to free capacitor leads.
3. Disconnect **Capacitor** leads *(see Figure 58: Capacitors Installed)* from **Therapy Board**.

   Caution: Equipment Damage.
   Carefully note the capacitor lead connection points and double check the lead and jack labels. Connecting the **Capacitors** to the wrong jack could cause equipment damage.

4. Reconnect **Capacitors**. Ensure lead connections are tight.
5. Tie wrap leads and cables. Refer to the assembly instructions for proper cable routing.
6. If necessary replace or reseat rubber tubing along the edge of the **Front Body**.
7. Replace the **Rear Cover**. Ensure the cover seats properly—check for gaps or bulges around the entire edge.

   Note: One screw is located under the label of the Rear Cover. (See Figure 67: Rear Body Installed)

8. Replace **Bed Hook Covers**. Check for proper orientation *(see Figure 68: Bed Hook Cover Improperly Installed)*.

Therapy Board (see page 45)

1. Follow the **Capacitor** instructions (above) to remove the **Capacitors**.
2. Disconnect all other leads from the **Therapy Board** *(see Figure 56: **Therapy Board** Cables Installed)*.
3. Remove the screws holding the **Therapy Board** *(see Figure 54: **Therapy Board** Installed)*.
4. Exchange the board and replace screws.
5. Reconnect all cables and leads.

   Caution: Equipment Damage.
   Carefully note the capacitor lead connection points and double check the lead and jack labels. Connecting the **Capacitors** to the wrong jack could cause equipment damage.

6. Follow the **Capacitor** instructions (above) to complete the reassembly.

SPO2 Board (see page 44)

Note: Most SP02 failures are the result of bad sensors. Before replacing the **SPO2 Board**, be sure to complete the troubleshooting procedure on page 24 to verify the board is the cause of the fault.

1. Follow the **Capacitor** and **Therapy Board** instructions (above) to remove the **Capacitors** and **Therapy Board**.
2. Remove the screws holding the **SPO2 Board** *(see Figure 51: SPO2 Board Installed)*.
3. Lift the **SPO2 Board** out to disconnect it from the **Main Board**.
4. Disconnect the SPO2 cable.
5. Exchange the board and reconnect the SPO2 cable.
6. Reconnect the **SPO2 Board** to the **Main Board**.
7. Replace the screws.
8. Follow the **Therapy Board** and **Capacitor** instructions (above) to replace the **Therapy Board** and **Capacitors**.

ECG Board (see page 40)

Note: Most ECG failures are the result of bad cables or sensors. Before replacing the **ECG Board**, be sure to complete the troubleshooting procedure on page 25 to verify the board is the cause of the fault.

1. Follow the **Capacitor** and **Therapy Board** instructions (above) to remove the **Capacitors** and **Therapy Board**.
2. Remove the **ECG Board** EMI shield.
3. Disconnect the ECG cable *(see Figure 41: ECG Cable Installation Detail)*.
4. Remove the screws holding the **ECG Board**.
5. Exchange the board and replace the screws.
6. Reconnect the ECG cable.
7. Replace the **ECG Board** EMI shield.
8. Follow the **Therapy Board** and **Capacitor** instructions (above) to replace the **Therapy Board** and **Capacitors**.

Display/Main Board/Printer (see page 42)

1. Follow the **Capacitor**, **Therapy Board**, **SPO2 Board**, and **ECG Board** instructions (above) to remove the **Capacitors Therapy Board, SPO2 Board,** and **ECG Board.**
2. Remove the screws holding the **Front Bezel** *(see Figure 45: Front Bezel Installed)*.
3. Remove the screws holding the **Display** *(see Figure 43: LCD Screw Locations)*.

At this point the **Display** can be replaced (disconnect **Display** cables).

If the **Main Board** or **Printer** must be replaced, perform the following steps:

Main Board

a. Remove the screws *(see Figure 11: Main Board Installed)*.
b. Disconnect all cables
c. Exchange the Main Board.
d. Reconnect all cables.
e. Replace the screws.

Printer

a. Remove the screws *(see Figure 14: Printer Screws)*.
b. Disconnect the ribbon and Power cables.
c. Exchange the **Printer**.
d. Reconnect ribbon and Power cables.

Note: Removing the printer bracket may help when connecting the Printer ribbon cable to the Main Board (see *Figure 10: Printer Bracket Removal*).

e. Replace the screws.

4. Connect the **Display** cables.
5. Replace the **Display** screws.
6. Follow the **ECG Board**, **SPO2 Board**, **Therapy Board**, and **Capacitor** instructions (above) to replace the **ECG Board**, **SPO2 Board**, **Therapy Board**, and **Capacitor.**

Power Supply and Power Control Board (see page 36)

Remove the **Base Cover**, disconnect all cables, and remove screws.

Note: The Power Supply is held in place only by the two larger Base Cover screws.

Switches and Fan (see page 36)

Remove **Base Cover** and **Power Control Board.**

Assembly

Overview

The following section details the assembly steps starting from a fully disassembled Responder 2000. When replacing a single board or other component, not all reassembly steps may be applicable.

WARNING: Lethal Shock Hazard.
In the event of equipment failure, the two main capacitors may retain dangerous voltages even if the Responder 2000 is disconnected from AC power and the battery is removed. Normally, the capacitors are discharged when power is shut off; however, it is possible for equipment damage to prevent the capacitors from discharging properly.

Always assume the capacitors are fully charged.

Caution: Shock Hazard or Equipment Damage.
Before opening the case, ensure the AC power cord is disconnected and the battery is removed.

Caution: Procedure Failure.
Even though some assembly steps may not be applicable to a specific replacement procedure, all other steps must be performed in the order listed.

Paddle Latch Assembly

Assembly Step	Details
Install **Paddle Latch**, three springs, and **Paddle Latch Retainer** (using two Phillips screws) on each side of the **Front Body**. **Note:** Ensure the **Paddle Latches** are oriented correctly and the Paddle Latch notch fits into the grove on the Front Body. Apply Silicone sealant to the lower half of the joint between the **Front Body** and the **Paddle Latch Retainer**. **Note:** The seal must be complete (no gaps).	 **Figure 1: Front Body Assembly (Front View)** **Figure 2: Orientation Detail** **Figure 3: Assembled Latch** **Figure 4: Silicone Application**

Main Board and Printer Installation

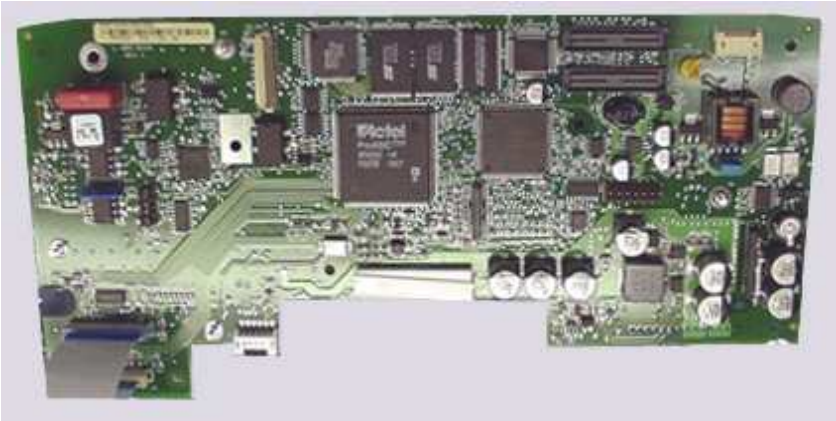
Assembly Step	Details
Install Ribbon Cables on **Main Board** at **J210** and **J218**. **Note:** Ensure the colored strip on cable into **J218** is visible when board is oriented as shown. **Note:** Ensure cables are installed correctly as shown below.	

Figure 5: Main Board

Cable Installation Notes

Figure 6 shows the cable correctly inserted into the jack.

Figure 7 shows the jack latch not fully engaged (latches on both sides must be fully depressed).

Figure 8 shows the cable not fully inserted into the jack.

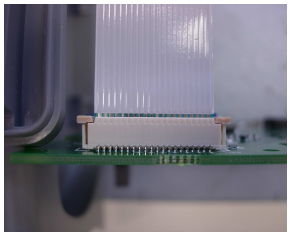


Figure 6: Good: Proper Installation

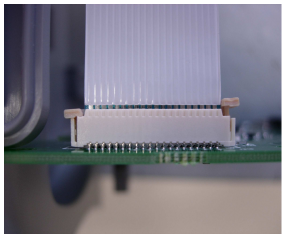


Figure 7: Bad: Jack Latch not Fully Engaged

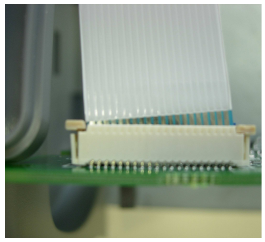


Figure 8: Bad: Cable not Fully Inserted

Note: the following steps detail replacing the entire printer. If the only the printer door is replaced, see Figure 46 for printer door installation.

Remove the **Printer Roller** and connect the printer cables to **J219** and **J220**.

Note: Ensure the cable and cable plug are fully inserted into the cable jacks.

Note: Removing the printer bracket may help when connecting the Printer ribbon cable to the **Main Board**.

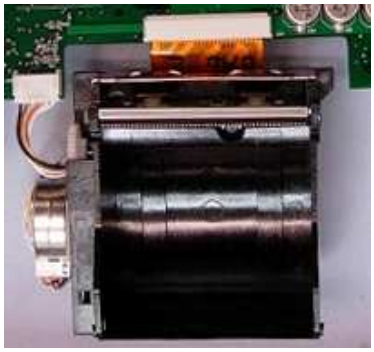
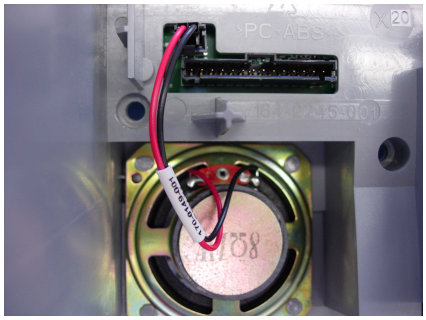
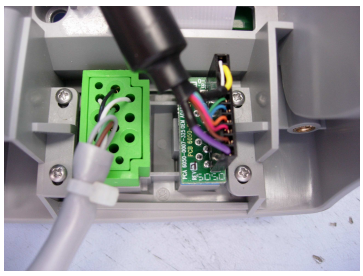
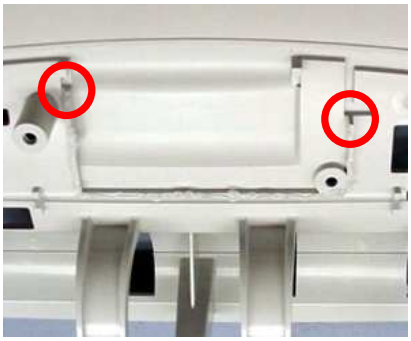


Figure 9: Printer Connections

Figure 10: Printer Bracket Removal

Assembly Step	Details
Place the **Main Board** and **Printer** into the **Front Body**. Tuck the ribbon cables connected to **J210** and **J218** as shown. Secure the **Main Board** with seven Philips screws and install the copper **Contact Spring** as shown. **Note:** Ensure the printer ribbon cable does not twist during installation.	 **Figure 11: Main Board Installed** **Figure 12: Cable Detail** **Figure 13: Copper Contact Spring Installation Detail**
Turn the assembly over (support the **Printer** so the cable does not twist) and secure the printer with three Phillips screws. **Note:** Tighten the center screw first to properly align the **Printer**.	 **Figure 14: Printer Screws**
Connect the speaker cable to **Main Board J216**.	 **Figure 15: Speaker Connection**

Assembly Step	Details
Connect the EGG cable (and optional SPO2 cable) to the cable cover. Secure to the **Front Body** assembly with four Phillips screws **Note:** Ensure the heart symbol is not upside-down.	 **Figure 16: ECG Cable Cover Installed** **Figure 17: Correct Orientation**
Insert the **Rotary Selection** switch as shown. Turn over the **Front Body** assembly and place the washer over the encoder switch. Tighten the nut and press on the **Rotary Selection Knob**. **Note:** When properly installed, the knob rotates freely and clicks when pressed. **Caution:** The connection between the encoder switch and cable is fragile. Do not excessively bend or twist the cable	 **Figure 18: Encoder Switch (Rear View)**
Apply a 5 mm (3/16 in) bead of silicone to seal the joint between the **Front Body** and the **Lower Frame** (between the two points as shown). **Note:** The seal must be complete (no gaps).	 **Figure 19: Lower Frame Silicone Application**

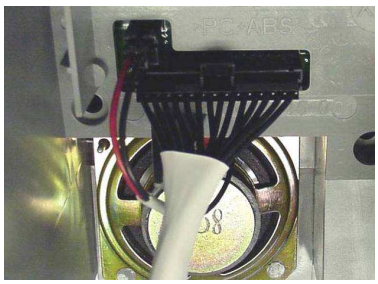
Assembly Step	Details
Connect the **CPU Main Cable** to **Main Board J211**.	

Figure 20: CPU Main Cable

Power Control Board and Power Supply Installation

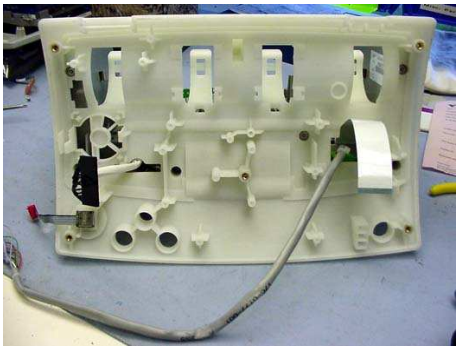
Assembly Step	Details
Pass the three cables through the holes in the **Lower Frame** as shown. Secure the **Lower Frame** to the **Front Body** with six Torx security screws.	

Figure 21: Lower Frame (Bottom View)

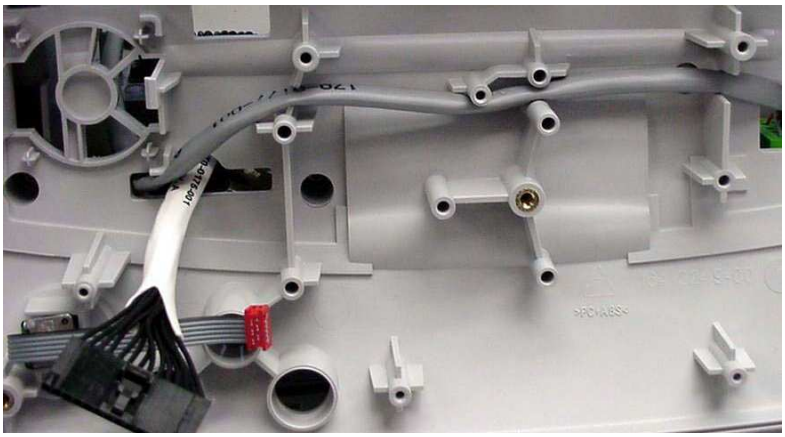
Route the **ECG Cable** as shown and pass it back up into the main compartment.	

Figure 22: ECG Cable Route through Lower Frame

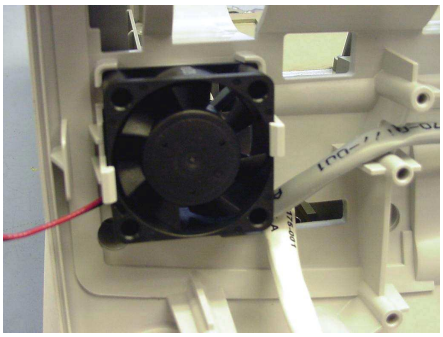
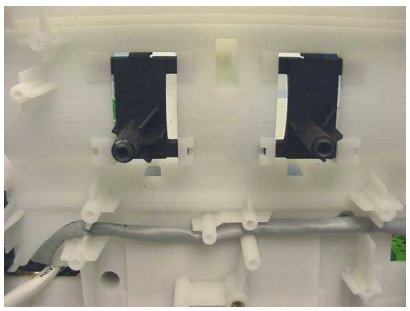
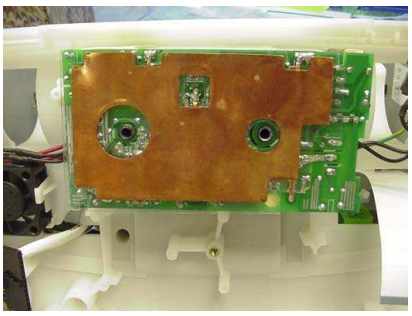
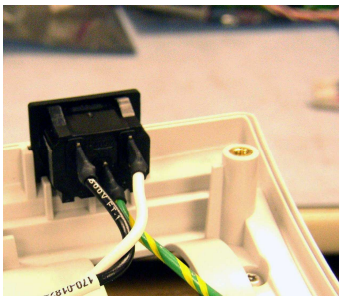
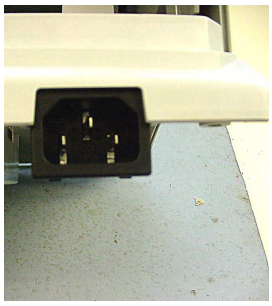
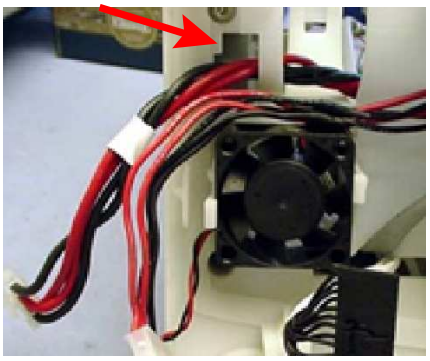
Install the **Fan**. **Note:** An arrow on the fan indicates air flow direction. Ensure the fan blows upwards into the unit.	

Figure 23: Fan Installed

Assembly Step	Details
Snap the two black **Brackets** into place on the **Lower Frame**. **Note:** Check the **Power Supply** green ground wire to ensure it is properly soldered on both ends and is in good condition. Place the **Power Supply** on the **Brackets**. **Note:** The **Power Supply** is not secured until the **Base Cover** is installed.	 **Figure 24: Brackets Installed**  **Figure 25: Power Supply Installed**
Place the **AC Cable Connector** into the **Lower Frame** as shown. **Note:** The single ground pin must be at the top.	 **Figure 26: AC Cable Connector**  **Figure 27: Proper Connector Orientation**
Insert the **Power Button** and **Control Button** assemblies into the **Lower Frame**.	 **Figure 28: Power and Control Button Assemblies Installed**
Pass **Therapy Power Cable** into the **Lower Frame** as shown. Pull the slack through, leaving enough length to connect to **Power Control Board** (installed in the next step).	 **Figure 29: Therapy Power Cable**

Assembly Step	Details

Secure the **Power Control Board** with five Phillips screws.

Place the **Service Connector** (serial connector) on the **Lower Frame**.

Note: Pin 1 must be at the top.

Route and connect all cables as shown.

Note: See the Ribbon Cable Installation Notes for proper installation (Figures 6, 7 and 8).

Figure 30: Power Control Board Installed

Figure 31: Service Connector (Correct Orientation)

Install the **Battery Release** and extension spring.

Note: To help the **Battery Release** slide under the **Power Control board**, back off the screws holding the **Power Control board** a turn or two and then retighten after installation.

Figure 32: Battery Release Installed

If necessary, reinstall rubber tubing along the edge of the **Lower Frame**.

Two lengths are required:

- 705 mm ± 3 mm (27-3/4 in ± 1/8 in)
- 148 mm ± 2 mm (5-15/16 in ± 1/16 in)

Note: Do not stretch the tubing as it is inserted into the groove.

Note: The gap between the end of the groove and the start of the tubing must be 2 mm (1/16 in) or less.

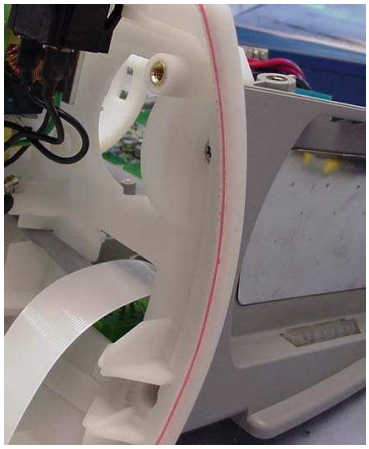


Figure 33: Tubing Properly Installed

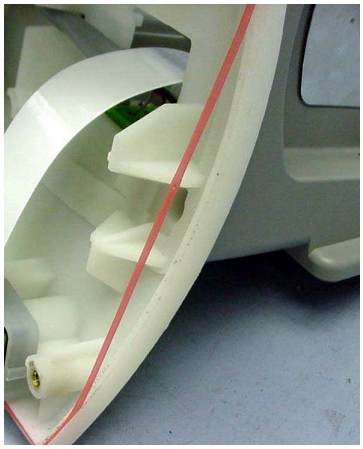
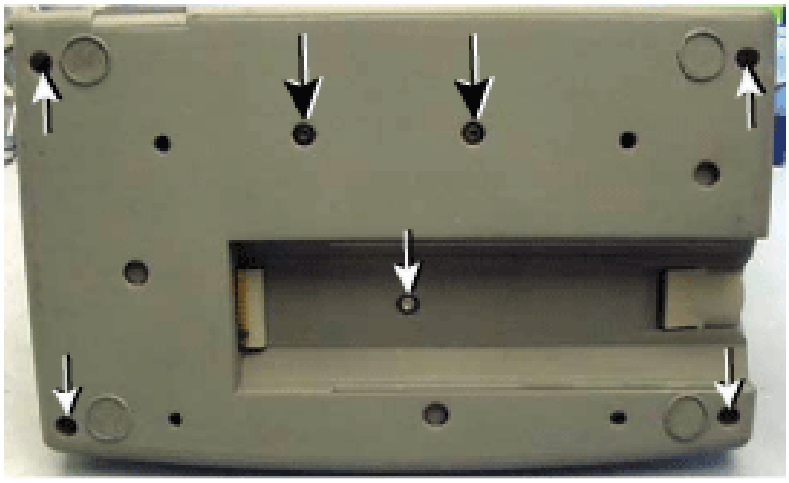
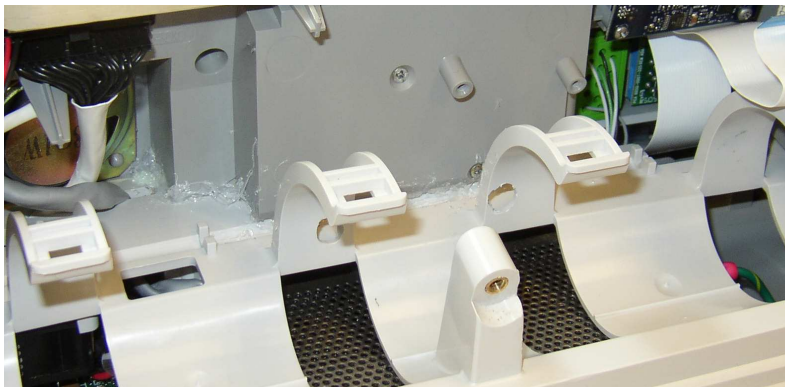
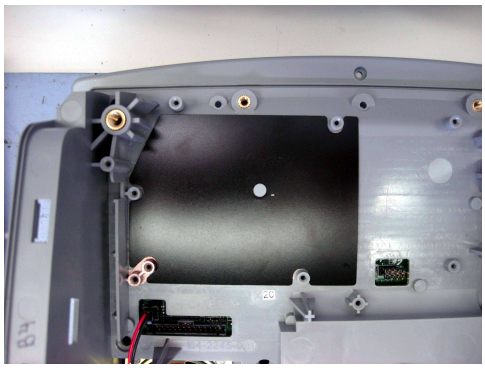
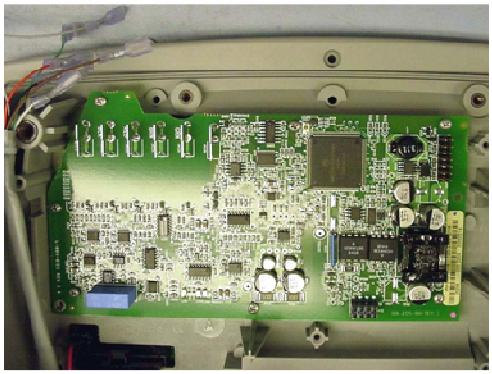
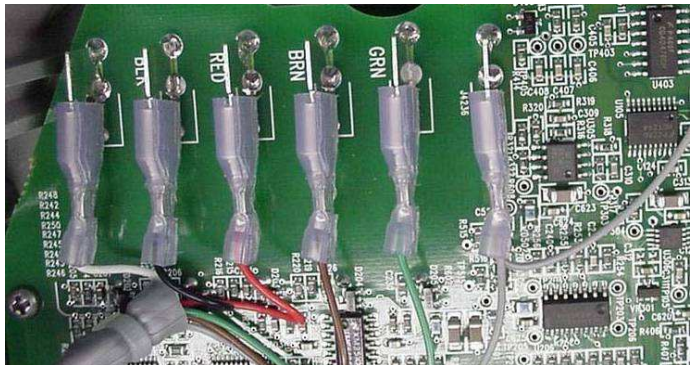


Figure 34: Tubing Not Properly Installed

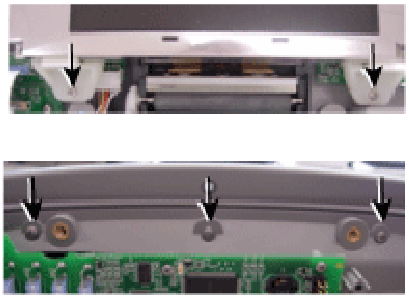
Assembly Step	Details
Install the **Battery Latch** in the **Base Cover**. Apply Silicone to the notch for the AC power plug.	 **Figure 35: Battery Latch** **Figure 36: Silicone Applied**
Install the **Base Cover** to the **Lower Frame**. Using five Torx security screws (white arrows). **Note:** Tighten the screws slowly and evenly to ensure the rubber tubing is seated correctly and no wires are pinched. When all screws are tightened, check for any gaps or bulges in the seal. Install the two larger Torx security screws (black arrows) to hold the **Power Supply** in place. Install the four rubber feet if necessary.	 **Figure 37: Base Cover**
If necessary, check the joint between the **Lower Frame** and the **Front Body** for gaps in the silicone. Add more silicone if necessary.	 **Figure 38: Front Body and Lower Frame Joint (with Correctly Applied Silicone)**

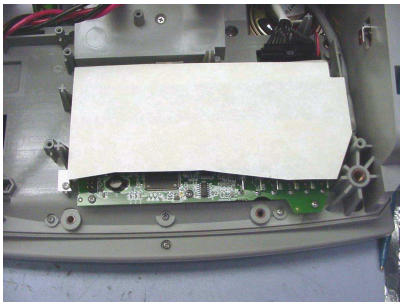
ECG Board Installation

Assembly Step	Details
Install the **ECG Insulator** in the **Front Body**.	
	Figure 39: ECG Insulator Installed
Install the **ECG Board** to the **Front Body** by connecting **J412** on the **ECG Board** to **J212** on the **Main Board**. Install the seven Phillips screws to hold the **ECG Board** in place.	
	Figure 40: ECG Board Installed
Connect the ECG cable to the **ECG Board**. • J4231 White • J4232 Black • J4233 Red • J4234 Brown • J4235 Green • J4236 Gray **Notes:** Gently pull on each connector to ensure it is locked in place. The extra gray connector will be connected later.	
	Figure 41: ECG Cable Installation Detail

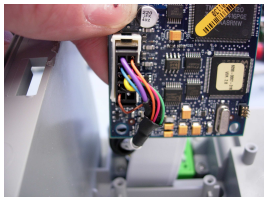
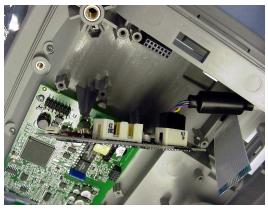
Assembly Step	Details
	Note: The next section details the **Front Bezel** and **Display** replacement. That procedure includes steps to route the ECG cable and install the ECG Shield for the **ECG Board**. Even if the **Display** or **Front Bezel** is not replaced, those steps must still be completed (see Figure 47 and Figure 48).

Display Installation

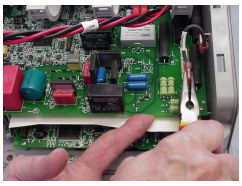
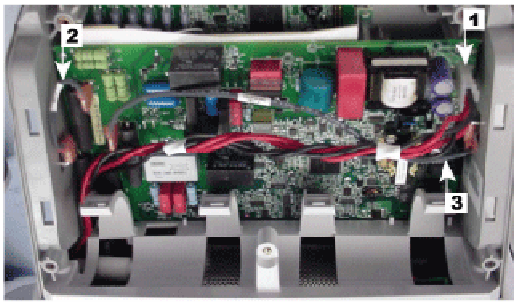
Assembly Step	Details
If necessary, snap the **LCD** into the **LCD Retainer**. Connect the LCD ribbon cable to **J214** on the **Main Board**. **Note:** See the Ribbon Cable Installation Notes for proper installation (Figures 6, 7 and 8). Secure the **LCD** to the **Front Body** with five Phillips screws (two in front, three in back).	 **Figure 42: LCD Installed in LCD Retainer**  **Figure 43: LCD Screw Locations**
Connect the LCD backlight cable to **J213** on the **Main Board**. **Note:** Twist the cable 9 to 15 times and fold it over the **LCD Retainer** as shown. Remove the protective film from the **LCD**. **Caution: Equipment Damage.** Do not touch the front of the LCD.	 **Figure 44: LCD Backlight Cable (Properly Routed)** **Caution: Shock Hazard or Equipment Damage.** The Responder 2000 is energized for the following step to verify proper operation. Exposed circuit boards may contain potentially dangerous voltages. Do not touch exposed electronics and keep all tools clear while performing the verification. At this point the assembly may be verified by connecting AC Power and turning on the unit. The display should be clear and bright. When the check is complete, turn the power off and disconnect the AC power cord. **Note:** This test will cause a service code error because the **Therapy board** is not installed. Delete this error when reassembly is complete.

Assembly Step	Details
If necessary, remove protective paper and plastic from inside the **Front Bezel**. **Caution: Equipment Damage.** Do not touch the inside of the **Front Bezel**. Clean the LCD and inside of the Front Bezel with a brush or compressed air. Ensure the plastic is clean and not scratched. Install the Front Bezel with six Torx security screws (white arrows) and one Phillips screw (black arrow). **Note:** Install the **Front Bezel** before assembling the circuit boards on the main compartment of the unit; otherwise you might not be able to access the Front Bezel screws.	 **Figure 45: Front Bezel Installed**
Install the **Printer Door** into the **Front Body** (insert the left side and then snap the right side into place. Note the roller orientation. The left side of the door is inserted first. Open and close the door several times to ensure proper installation.	 **Figure 46: Printer Door Installation**
Route the ECG cable and connect the remaining gray ECG cable connector to the clip in the **ECG Shield**. Install the **ECG Shield** in the **Front Body** with three Phillips screws.	 **Figure 47: ECG Cable (Properly Routed)**  **Figure 48: ECG Shield Installed**

SPO_2 Board Installation

Assembly Step	Details
Perform the Following step only if the SPO2 option is installed. Connect the ECG/SPO2 cable to **X16** on the **SPO2 Board**. Connect **X14** on the **SPO2 Board** to **J221** on the **Main Board** and then secure with four Phillips screws.	 **Figure 49: SPO_2 Cable Installed**  **Figure 50: SPO_2 Board Installation** **Figure 51: SPO_2 Board Installed**

Therapy Board Installation

Assembly Step	Details
Connect the ribbon cable to **J110** on the **Therapy Board**. **Note:** See the Ribbon Cable Installation Notes for proper installation (Figures 6, 7 and 8). Fold the connected cable under the **Therapy Board**. Install the **Therapy Board** with four Phillips screws.	 **Figure 52: Therapy Board Ribbon Cable Installation** **Figure 53: Ribbon Cable Routing** **Figure 54: Therapy Board Installed**
Connect the following cables to the **Therapy Board**: 1. J103: Therapy Power cable 2. J217 Charge Drain cable (left) 3. J216 Charge Drain cable (right) **Note:** Use one finger to support the **Therapy Board** when making the connections.	 **Figure 55: Therapy Board Support**  **Figure 56: Therapy Board Cables Installed**

Capacitor Installation

Assembly Step	Details

Insert one tie wrap through each capacitor support bracket. The tie wraps are used to secure the **Therapy Board** power cable, left Charge Drain cable, and the **Capacitor** lead wires after the lead wires are connected.

Figure 57: Tie Wrap Installation Detail

Place each **Capacitor** in its support bracket.

Connect the lead wires to the **Therapy Board**:

- J105 & J107: White lead wires
- J104 & J106: Red lead wires

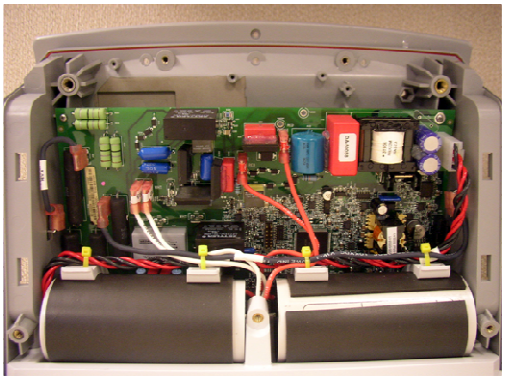


Figure 58: Capacitors Installed

Secure the **Therapy Board** power cable, left Charge Drain cable, and the **Capacitor** lead wires with the tie wraps.

Caution: Equipment Damage. Misrouting or leaving too much slack in the wires may cause wires to contact hot components or become damaged during reassembly. Ensure all wires are routed and all plugs are oriented exactly as shown in Figure 58: Capacitors Installed.

Figure 59: Lead Wire Installation Detail

Specific areas include:

- Red capacitor wires must have no slack between the board connectors and the tie wrap to keep the wires away from the **Therapy Board** components.
- The red/black cable bundle must be routed down the side of the left **capacitor**, not behind it.
- Ensure the lead wires are routed behind the plastic center mount.

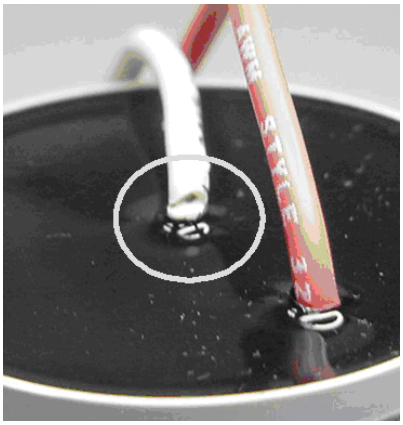


Figure 60: Capacitor Lead Break

Caution: Equipment Damage. When installing the capacitors, avoid excess strain on the capacitor leads. Excessive force can break or damage the lead connection.

Rear Cover Installation

Assembly Step	Details
If necessary, insert Rubber Tubing (279 mm ±3 mm 11 in ± 1/8 in) into the groove on the **Front Body**. **Note:** See Figure 33 for installation note.	

Figure 61: Front Body Tubing Installed

Install **Handle** to the **Rear Body** with two Torx security screws and two washers.

Figure 62: Handle Installed

1. Tie cables to **Rear Body**.
2. Pull patient cables to a length of 5.5” to 6”, measured from the plastic rib shown to the top of the plugs.
3. Tuck service loop under patient connector.

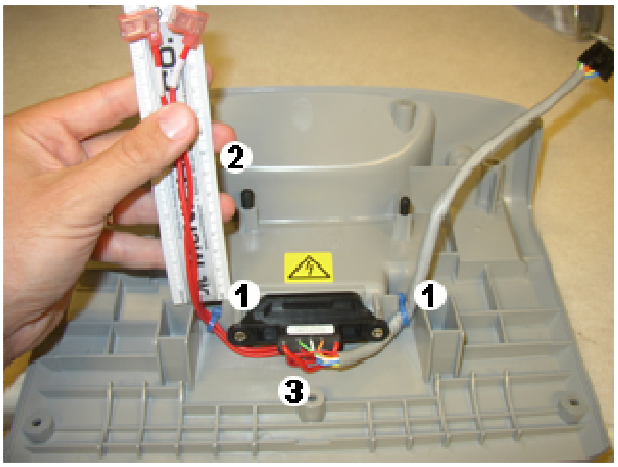


Figure 63: Rear Cover Cable Installation

Assembly Step	Details

1. Connect **P101** (Red Paddle wire) from **Rear Body** to **J101** on the **Therapy Board**. Then connect **P102** to **J102**.
2. Connect gray Paddle Cable to **J109** of **Therapy Board**.

Notes: Ensure the wires are routed exactly as shown.

The red patient wires (labeled 1) must go under the white cap wires. Also, both plugs of the red patient connector wires must be pointing left.

Caution: Equipment Damage. J122 is not used. Ensure no cable is connected to this jack.

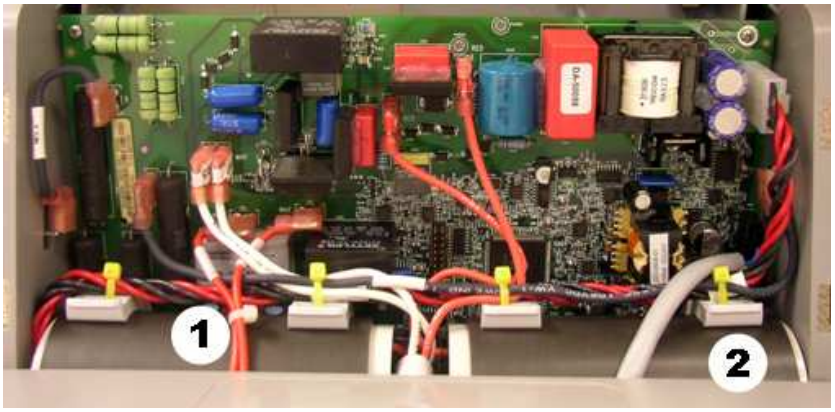


Figure 64: Paddle Cables Connected

To attach the **Rear Body,** lift the **Rear Body** and twist 180 degrees counterclockwise to assemble into position.

Note: Ensure the red and gray wire bundles are to cross as shown.

Figure 65: Rear Body Placement

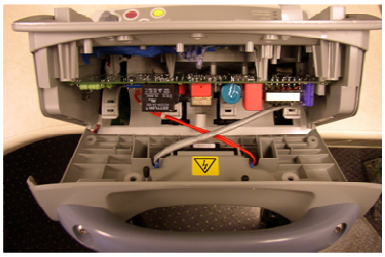


Figure 66: Rear Body Assembly

Assembly Step	Details

Install **Rear Body** to **Front Body** using five small Torx security screws and two large Torx security screws.

Note: Tighten all screws slowly and evenly. Check for bulges, gaps, or pinched wires before tightening completely.

Install **Bed Hook Covers** using two Phillips screws.

Note: Ensure **Bed Hook Covers** are properly installed.

Figure 67: Rear Body Installed

Figure 68: Bed Hook Cover Improperly Installed (Right Cover on Left Side)

Section 5: Performance Verification and Safety Testing

Overview

This section describes how to perform service maintenance and testing of the Responder 2000 after repairs are performed.

TOPIC	PAGE
Required Equipment	51
Preventive Maintenance	51
Annual Inspection	51
Verify Operation	52
Maintenance Menu Reference	53
Visual Inspection	59
Operational Tests	60
Safety Tests	69
Alternate Safety Test Procedures	75

Required Equipment

- Fluke Model Index 2 Sp02 simulator or (equivalent)
- Fluke Model Impulse 4000 Defib analyzer (or equivalent)
- Metron QA-90 Safety Analyzer (or equivalent)
- UadTech Sentry 30 AC/DC/IR Hipot Tester

PRECAUTION: Do not shock into devices with highly non-linear resistance versus the voltage, (e.g. an overvoltage protector). **This may damage the Responder 2000. Do not use** the HELLIGE Test Lamp 301 495 00 for testing. This test lamp includes an overvoltage protector. Shocking into it may damage the Responder 2000.

HELLIGE Test Lamp

Preventive Maintenance

The following preventative maintenance and operational checks are normally performed only by the user:

- Cleaning the Responder 2000 or accessories
- Calibrating the battery fuel gauge
- Daily maintenance per Defibrillator Checklist
- Other routine maintenance

Refer to the Operator's Manual for more information.

Annual Inspection

A qualified service technician should check the Responder 2000 once per year for the following:

1. Visual Inspection (page 59)
2. Operational Check (starting on page 60)
3. Printer Test (page 68)

Verify Operation

Before performing service on the Responder 2000, use the following procedures to configure and test the Responder 2000 to verify proper operation (or locate a fault condition):

- Visual Inspection (page 59)
- Operational Tests (starting on page 60)

Checkout Procedures

After service, the following operational and safety procedures must be performed to verify proper operation. All tests indicated must be performed before the Responder 2000 can be returned to the customer. Depending on the type of repair, the following procedures must be performed for each of the following cases:

- External Repairs or Replacement

  External repairs/replacements do not require opening the case. After repair or replacement, perform a Visual Inspection (page 59).

- Printer Door Replacement

  The printer door may be replaced without opening the case. After the printer door is replaced (and the case was not opened) the following tests must be performed:

  1. Visual Inspection (page 59)
  2. Printer Test (page 68)

- Internal Repairs

  If the case is opened, the following tests must be performed after the repair:

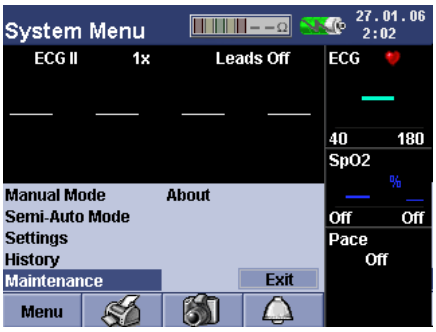
  1. Visual Inspection (page 59)
  2. Operational Check (starting on page 60)
  3. Safety Checks (starting on page 69)

Maintenance Menu Reference

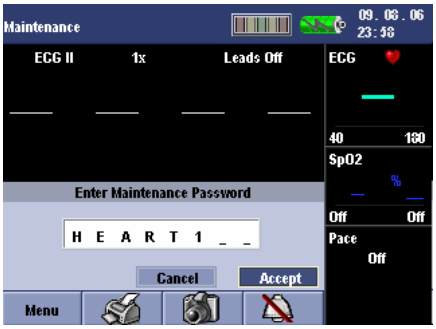
Caution: Loss of Patient Data
Do not enter Maintenance mode while the Responder 2000 is connected to a patient. Patient data may be lost. Perform any Maintenance mode procedures outside the patient vicinity.

Note: The Responder 2000 battery must have at least a 20% charge before performing these procedures.

The following Maintenance Menu items are listed as a reference for quick troubleshooting or verification and are not intended as a comprehensive operational or safety checkout. The entire checkout procedures listed above must be performed before returning the Responder 2000 to the customer.



Note: A password is required to access the Maintenance menu. The default password is HEART1, but may have been changed by the facility. To enter a password:

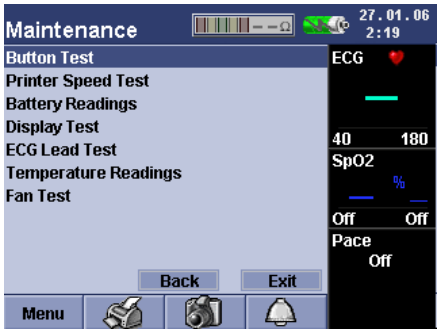


1. Select **Maintenance** from the **System** menu. The password field is displayed, highlighted.
2. Click to highlight the first character field.
3. Click the highlighted field, and then rotate the encoder button to the first letter of the password.
4. Click to accept the letter and then rotate to the next field.
5. After all password characters are entered, rotate one space past the last character field. The border around the password field highlights.
6. Click to highlight the password field and then rotate and click **Accept**.

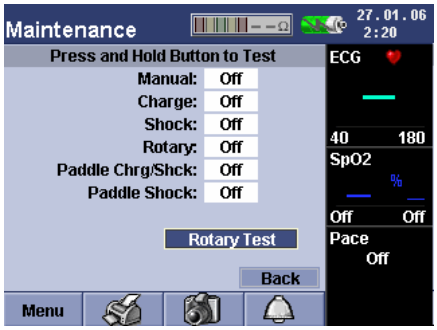
The Maintenance Menu has the following items:

- Service Tests: These tests, described below, are used to verify operation
- Device Configuration: Used to set the language
- Stored Data Management: Used to clear stored data or settings, transfer stored logs to a PC, and save or load stored settings

Service Tests



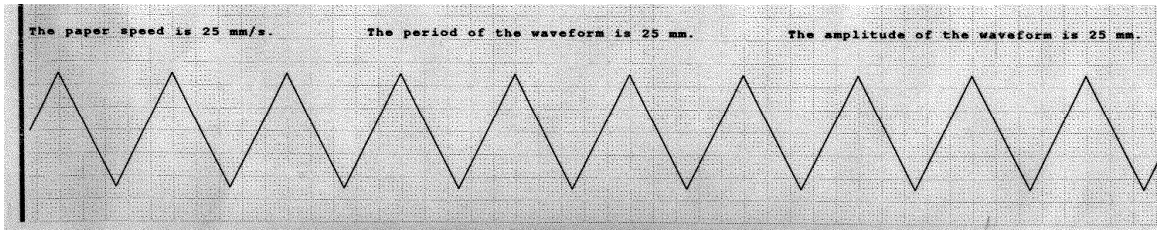
Button Test



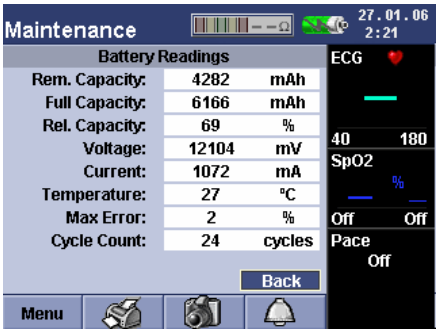
- Press and hold each button to test. **On** while the button is pressed (and **Off** when not pressed) indicates the button is working properly.
- To test the **Rotary Selection** knob, rotate to highlight **Rotary Test** and press the **Rotary Selection** knob. **Rotary** should indicate **On**.

Printer Speed Test

Prints a test strip at a constant speed of 25 mm/s with a 25 mm period and 25 mm amplitude:



Battery Readings

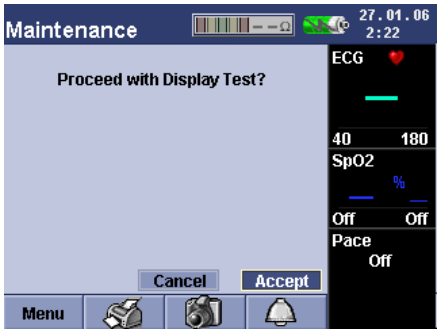


Heading	Description
Full Capacity	Capacity of a fully charged battery
Rem. Capacity	Current battery charge
Rel. Capacity	Current charge as a percentage of the full capacity

Normally this screen is used to verify the battery is charging (or fully charged) at the appropriate voltage. Service tests must be performed with the battery at least 20% charged.

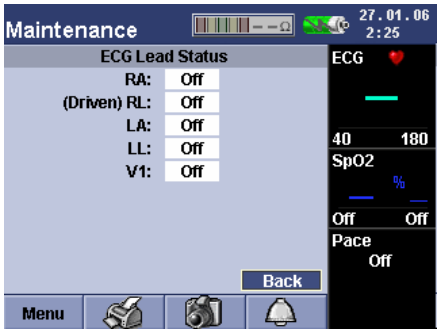
- New batteries have a full capacity of at least 6000 mAH and will charge when the Responder 2000 is plugged into an AC outlet.
- If the battery is fully charged and has a capacity of less than 4500 mAH, calibrate the battery (see Battery Calibration on page11).
- If the battery still has a capacity of less than 4500 mAH after calibration, then replace the battery.

Display Test



The following colors fill the entire display in succession: White, Red, Green, Blue, and Black. Verify no pixels are stuck or missing. After the test, the Responder 2000 then automatically cycles power.

ECG Lead Test

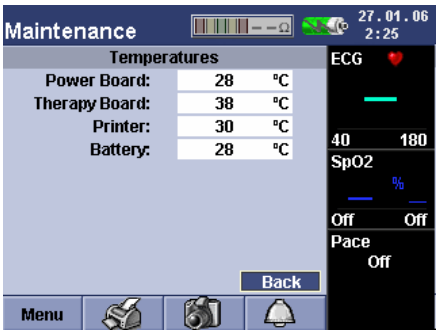


Displays lead status (on or off). See the ECG Lead Test Procedure on page 67 for proper indications.

Notes:

- If the lead RA, LA, LL or V1 is not connected (to either a Patient or ECG Simulator) or the lead is broken, the Lead status displays **OFF**.
- If (Driven) RL lead is not connected or broken, all lead status are displayed **OFF**.

Temperature Readings

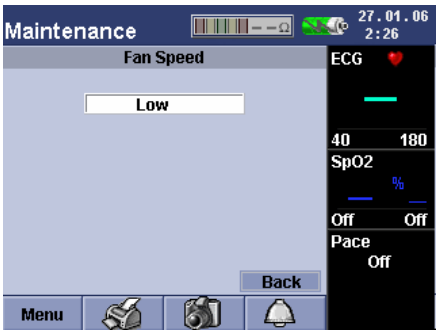


Displays internal temperatures for the **Power Board, Therapy Board**, **Printer**, and **Battery**. These readings may vary according to fan speed or external conditions. An abnormally high reading may indicate a fan not working or other fault.

The internal fan should turn on at the following temperatures:

	Fan ON (High)	Fan ON (Low)	Fan OFF
Power Board	65º	60º	55º
Therapy Board	65º	60º	55º
Printer	N/A	N/A	N/A
Battery	N/A	N/A	N/A

Fan Test



Select **Off, Low,** or **High**

Note: The Low fan speed may be difficult to hear in a noisy environment.

Device Configuration

Select Language

Sets the system language to: English, French, German, Italian, Dutch, Portuguese, Russian, Spanish, or Swedish. Once a new language is selected, the Responder 2000 cycles power.

Note: Maintenance mode text is always in English, regardless of the language selected.

Stored Data Management

Clear Event Logs

Clears all stored event logs. Always clear event logs after the **Main** board is replaced.

Clear Service Required Indicator

Clears the **Service Required** LED. Once a service fault is corrected, use the **Clear Service Required** menu item to turn off the **Service Required** LED. If the LED does not clear, another fault is present.

Clear Settings Menu Password

Clears the **Settings Menu** password.

Clear All Stored Data

Clears all stored data, including:

- Event Logs
- Service Required Indicator
- Settings Menu Password
- All other Settings.

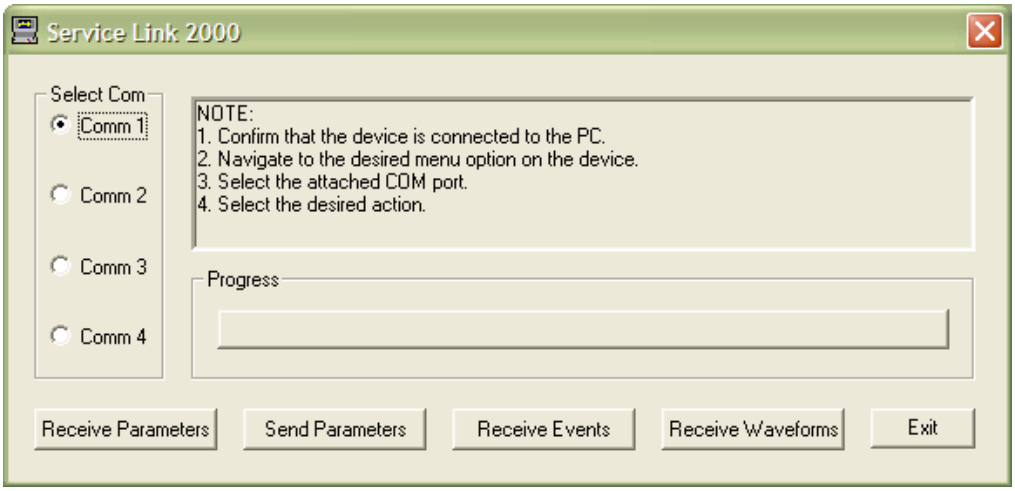
Send Event Logs to PC

Event logs may be downloaded to a PC and sent to Technical support to help troubleshoot a problem.

1. Go to **Service Mode** (password HEART1).
2. Select **Stored Data Management** > **Send Event Logs To PC**.
3. On the PC, start the Windows-based ServiceLink2000 Application.
4. Select the appropriate Com Port and click **Start Com**.
5. Click **Receive Events**. A progress bar is displayed.
6. When downloaded, save the events file to the desired location. A progress bar is displayed while the CSV file is saved.
7. The ServiceLink2000 program closes after the file is successfully saved.

Send/Receive Stored Parameters

Stored parameters should be downloaded before replacing a board, and then uploaded after the board is replaced to return the system to its original state.



To Retrieve Stored Parameters:

1. Go to **Service Mode** (password HEART1).
2. Select **Stored Data Management** > **Send/Receive Stored Parameters**.
3. On the PC, start the Windows-based ServiceLink2000 Application.
4. Select the appropriate Com Port and click **Start Com**.
5. Click **Receive Parameters**. A progress bar is displayed.
6. When downloaded, save the parameter file to the desired location. A progress bar is displayed while the file is saved.
7. The ServiceLink2000 program closes after the file is successfully saved.

To Send Stored Parameters

1. Go to **Service Mode** (password HEART1).
2. Select **Stored Data Management** > **Send/Receive Stored Parameters**.
3. On the PC, start the Windows-based ServiceLink2000 Application.
4. Select the appropriate Com Port and click **Start Com**.
5. Click **Send Parameters**.
6. Select the parameters to be uploaded and click **Open**. A progress bar is displayed
7. Check the Responder 2000 display. If *Params Set* is displayed, the upload was successful.
8. Click No to upload the parameters file again. If the parameters file was not uploaded successfully, retry as necessary.
9. The ServiceLink 2000 program closes after the file is successfully uploaded.

To Retrieve Stored Waveforms:

1. Go to **Service Mode** (password HEART1).
2. Select **Stored Data Management** > **Send/Receive Stored Parameters**.
3. On the PC, start the Windows-based ServiceLink2000 Application.
4. Select the appropriate Com Port and click **Start Com**.
5. Click **Receive Waveforms**. A progress bar is displayed.
6. When downloaded, save the waveform file to the desired location. A progress bar is displayed while the file is saved.
7. The ServiceLink2000 program closes after the file is successfully saved.

Visual Inspection

Visually inspect the unit and accessories for foreign substances, damage, cracks, bent or discolored pins, broken parts, or extreme wear, including:

- Cracked, bulging, or otherwise damaged case
- Cracked, loose, or bent connectors or plugs
- Rattling when gently shaken
- Discoloration or signs of overheating
- Obvious scratches or damage to the display
- Loose battery or paddle clips
- Loose printer door

Operational Tests

Initial Power Up

Perform this procedure for the following scenarios:

- With a charged battery (at least 25%) installed and connected to AC power
- With the battery removed and connected to AC power
- With a charged battery (at least 25%) and AC power disconnected

Turn on the Responder 2000 and verify the following during power up:

- No alarms (at any time during power up or operation)
- The speaker emits a short beep, then is silent
- The following indicators momentarily light:
  - Service Required: Red
  - Charge: off
  - Manual: Blue
  - Shock: Red
- The Responder 2000 is ready for use in about 4 seconds.

The AC Power LED and Battery Charging LED are lit when a battery is installed and the Responder 2000 is connected to AC power

- The AC Power LED is not lit and Battery Charging LED is not lit when a battery is installed and the Responder 2000 is not connected to AC power

Maintenance Mode Tests

Perform each Maintenance Mode Tests (starting on page 54) to ensure proper operation.

Verify Serial Communications

Required Equipment

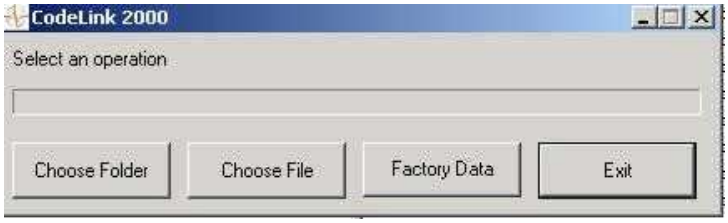
- Windows Based PC
- Serial Cable

Procedure

1. Turn off the Responder 2000.
2. Shut down the PC.
3. Connect the Serial cable from the Serial port on the Responder 2000 to the Serial port on the PC.
4. Turn on the PC.
5. Open Responder 2000 Upgrade program on the PC.
6. Select the appropriate COM port and press **OK** (normally COM 1).
7. Follow the on-screen instructions as shown:

CodeLink 2000
* Power down the R2K unit.
* Press the OK button for this message box.
* Turn on the R2K unit.
The unit will automatically go into upgrade/test mode.
OK

8. Verify the CodeLink 2000 window is displayed as shown:



9. Press **Exit** to close the window.
10. Power down the Responder 2000.
11. Shut down the PC.
12. Disconnect the Serial cable from the Responder 2000 and the PC.

Defibrillator Tests

Warning! Shock Hazard.

Before delivering any shock, ensure all personnel and equipment are clear of the test area.

Energy Timeout Test

1. Ensure the Responder 2000 has a charged battery (at least 25%) installed and is connected to AC power
2. Seat each paddle in its side holder. Ensure paddles are securely seated.
3. Press the **Manual** button on the Responder 2000.
4. Select an **Energy Level** of **100J**.
5. Press the **Charge** button on the front panel.
6. The message **Stand Clear** is displayed.
7. Do not press the Shock button. After 30 Seconds the message **Charge Time Out** should be displayed.

Defibrillator Test Chart

For each of the defibrillator tests below (Paddles, Pads, and Spoons), perform the test at the energy level indicated in the procedure. Then perform each test at the energy levels indicated in the chart below.

Note: Use only a calibrated Impulse 4000 (or equivalent) for pads and spoons. Energy values may vary slightly depending on the simulator used.

Selected Energy	Energy Delivered into 50 Ohm (Tolerance +/- 15 % or +/-3 Joule)	Test
2	0-5	Paddles, Pads, and Spoons
3	0-6	Paddles, Pads, and Spoons
5	2-8	Paddles, Pads, and Spoons
7	4-10	Paddles, Pads, and Spoons
10	7-13	Paddles, Pads, and Spoons
15	12-18	Paddles, Pads, and Spoons
20	17-23	Paddles, Pads, and Spoons
30	25.5-34.5	Paddles, Pads, and Spoons
50	42.5-57.5	Paddles, Pads, and Spoons
70	59.5-80.5	Paddles and Pads only
100	85-115	Paddles and Pads only
150	127.5-172.5	Paddles and Pads only
200	170-230	Paddles and Pads only
270	229.5-310.5	Paddles and Pads only

Paddles Test

1. Ensure the Responder 2000 has a charged battery (at least 25%) installed and is connected to AC power
2. Connect defibrillator paddles connector to the connector on the Responder 2000.
3. Seat each paddle in its side holder. Ensure paddles are securely seated.
4. Press the **Manual** button on the Responder 2000.
5. Select **Energy Level** of **270J**.
6. Press **Charge** button on APEX (right) paddle. Verify the Responder 2000 charges to a 270J level and the audible alarm sounds.
7. Simultaneously press and hold the **Shock** buttons on both paddles.
8. Verify that energy delivered is shown on the Responder 2000 display is between 229.5 to 310.5J.
9. Repeat this procedure with input power from:
   - With the battery removed and connected to AC power
   - With a charged battery (at least 25%) and AC power disconnected
10. Repeat this procedure using the energy levels listed in the table above with the following conditions:
    - Do not perform step 9 (this is only required once to verify the energy path)
    - Wait at least 30 seconds between each test shock

Pads Test

1. Ensure the Responder 2000 has a charged battery (at least 25%) installed and is connected to AC power
2. Connect the pads connector to the Responder 2000.
3. Connect the pads to the Impulse 4000.
4. Press the **Manual** button on the Responder 2000.
5. Select **Energy Level** of **270J**.
6. Press **Charge** button on front panel. Verify the Responder 2000 charges to a 270J level and the audible alarm sounds.
7. Press the **Shock** buttons on the front panel.
8. Verify that energy delivered is shown on the Responder 2000 display is between 229.5 to 310.5J.
9. Repeat this procedure using the energy levels listed in the table above with the following conditions:
   - Wait at least 30 seconds between each test shock

Spoons Test

1. Ensure the Responder 2000 has a charged battery (at least 25%) installed and is connected to AC power
2. Connect the spoons connector to the Responder 2000.
3. Connect the spoons to the Impulse 4000.
4. Press the **Manual** button on the Responder 2000.
5. Select **Energy Level** of **50J**.
6. Press **Charge** button on front panel. Verify the Responder 2000 charges to a 50J level and the audible alarm sounds.
7. Press the **Shock** buttons on the front panel.
8. Verify that energy delivered is shown on the Responder 2000 display is between 42.5-57.5J.
9. Repeat this procedure using the energy levels listed in the table above with the following conditions:
   - Do not select an Energy level greater than 50 Joules.
   - Wait at least 30 seconds between each test shock

Pacing Test

1. Connect pads cable to the back of therapy connector on the back of Responder 2000.
2. Connect pads to a Calibrated Impulse 4000 Defib/Pacer Analyzer or equivalent.
3. Turn on the Responder 2000.
4. Use **Rotary Selector Knob** to move focus to and select **Pacing Info** box in the lower right of the display.
   Note: If pacing is not enabled, the **Pacing Info** box is not selectable.
5. Turning the **Rotary Selector Knob** clockwise, the following items should be selectable::
   - Pacing Type (Fixed, Demand), Default is Demand.
   - PPM (30-180 PPM, increments of 5), Default is 60 PPM
   - Exit Pacing Info Box (“x” in corner)
   - Pacing On/Off/Pause (Pause is only available when Pacing is turned On)
   - Pacing Current (0mA-140mA, increments of 5). This option is only selectable when pacing is turned on.
6. Turn the **Rotary Selector Knob** to turn on the pacing.
7. When Pacing is turned on, focus automatically goes to the **Pacing Current** selection. Set desired pacing current.
8. Turn the **Rotary Selector Knob** to select pacing rate and set desired options for pacing rate.
9. Turn the **Rotary Selector Knob** to select pacing mode and set desired options for pacing mode.
10. Check each pacing current value using the chart below.
    Notes:
    - Use only a calibrated Impulse 4000 Defib/Pacer analyzer.
    - The measured values may vary slightly depending on the simulator used.
    - Wait for at least 30 seconds between each current setting.

Pacing Mode = Fixed Pacing Rate = 60 PPM	
Selected Current in mA on Responder 2000	**Current Delivered into 50 Ohm setup into Impulse 4000 or equivalent. Tolerance +/- 15% in mA**
40	34 – 46
45	38.25 – 51.75
50	42.5 – 57.5
55	46.75 – 63.25
60	51 - 69
65	55.25 - 74.75
70	59.5 - 80.5
75	63.75 - 86.25
80	68 - 92
85	72.25 - 97.75
90	76.5 - 103.5
95	80.75 - 109.25
100	85 - 115
105	89.25 - 120.75
110	93.5 - 126.5
115	97.75 - 132.25
120	102 - 138
125	106.25 - 143.75
130	110.5 - 149.5
135	114.75 - 155.25
140	119 - 161

ECG Tests

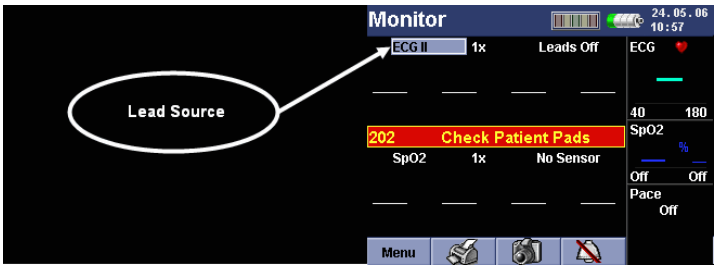
Required Equipment

- Impulse 4000 (or equivalent)

ECG Connections Test

1. Verify Responder 2000 is powered on.
2. Connect ECG leads (RL, RA, LA, LL, V1) to the corresponding connectors on the ECG Simulator.
3. Plug in the ECG Cable the ECG Cable Port on the Responder 2000.
4. Change ECG source to **ECGII**.
5. Select **ECG** > **Norm** > **80** on the ECG Simulator and verify the following on the Responder 2000:
   - The ECG signal on screen of Responder is correct amplitude and polarity
   - An audible beep sounds for each ECG beat

Lead Detection Test

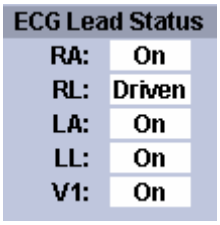


The diagram above indicates where the lead source is displayed.

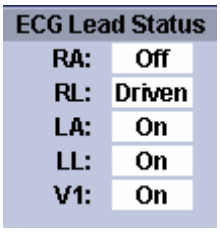
1. Verify Responder 2000 is powered on.
2. Verify default Lead Source on Responder 2000 is **ECG II**.
3. Connect the Spoons cable between Responder 2000 and Impulse 4000 (Apex and Sternum).
4. Select **Spoons** on the Responder 2000 display as the lead source and ensure the signal is displayed.
5. Disconnect Spoons and connect Paddles cable to the Responder 200. Ensure paddles are securely stored on left and right side of Responder 2000.
6. Select **Paddles** on the Responder 2000 display as the lead source and ensure the signal is displayed.
7. Disconnect paddles cable from Responder 2000 and connect pads cable to Responder 2000 and Apex/Sternum of Safety Analyzer.
8. Select **Pads** on the Responder 2000 display as the lead source and ensure the signal is displayed.
9. Connect ECG Sync Cable to Responder 2000's ECG connector.
10. Place the Responder 2000 in External Sync mode by performing the following:
    a. Press **Manual** button on Responder 2000.
    b. Select **2J** with Rotary Selection knob.
    c. Turn Rotary Selection knob until **No Sync** is highlighted.
    d. Press Rotary Selection knob to change to **Sync.**
11. Verify **Manual – Ext Sync** is shown on upper left corner of Responder 2000 display.
12. Disconnect Sync cable from Responder 2000 and connect a 3 Lead ECG cable.
13. Use Rotary Selection knob to exit previous menu and then select the Lead source.
14. Verify the following leads may be selected:
    - Paddles
    - ECG I
    - ECG II
    - ECG III
15. Disconnect 3 Lead ECG cable from Responder 200 and connect 5 Lead ECG cable to Responder 2000.
16. Verify the following leads may be selected:
    - Paddles
    - ECG I
    - ECG II
    - ECG III
    - aVR
    - aVF
    - aVL
    - V

ECG Lead Test

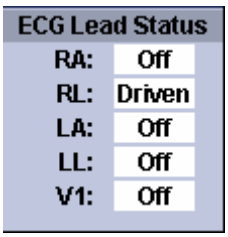
1. Connect the ECG leads to the patient simulator.
2. On the Responder 2000, select **ECG Lead Test** from the **Maintenance** menu.
3. Verify **ECG Lead Status** display as shown:



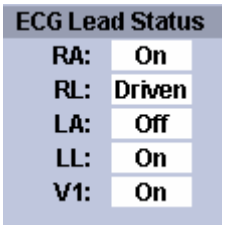
4. Disconnect RA (White Lead) from Patient Simulator and verify the display as shown:
5. Reconnect RA lead to patient simulator.



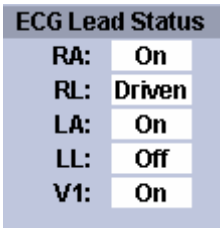
6. Disconnect RL (Green Lead) from Patient Simulator and verify the display as shown:
7. Reconnect RL lead to patient simulator.



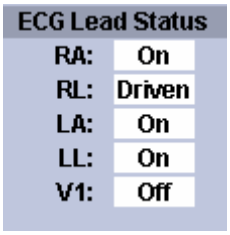
8. Disconnect LA (Black Lead) from Patient Simulator and verify the display as shown:
9. Reconnect LA lead to patient simulator.



10. Disconnect LL (Red Lead) from Patient Simulator and verify the display as shown:
11. Reconnect LL lead to patient simulator.



12. Disconnect V1 (Brown Lead) from Patient Simulator and verify the display as shown:
13. Disconnect all leads and return to the **Main** menu.



Paddles ECG Test

1. Select **Settings** > **Channel Settings** > **Paddles**.
2. Connect the Paddles to the Impulse 4000 and verify both the ECG and the HR value are displayed.
3. Select a Heart Rate of 60 BP/min on the simulator and verify if the display shows this value.

Thermal Printer Operation

1. Open printer door and verify the **Door Open** message is displayed.
2. Remove paper and close printer door and verify **Printer Paper Out** message is displayed.
3. Re-install paper in printer and close door and verify no printer error messages are displayed.
4. Select **Printer** icon and verify smooth, good quality printing with no stuck pixels.
5. Select **Printer** icon to stop printer and verify the patient/device information page is printed and that printing stops.
6. Tear off the paper strip and verify the paper tears properly.

Cardioversion Test

1. Connect the Paddles to the Impulse 4000.
2. Set Responder 2000 to **Manual Mode**.
3. Change the status from **No Sync Mode** to **Sync Mode**. Verify the **Manual-Sync** and the trigger is displayed to the QRS complex.
4. Simultaneously press and hold the **Shock** buttons on both paddles. Triggering is affected by the peak of the QRS complex of the beat and the Cardioversion function is automatically reset.
5. If the delay time is greater than 60ms, the test has failed.

SpO_2 Operation

Perform this test only if the Responder 2000 is equipped with the SpO_2 option.

1. Plug in the SpO_2 sensor connector.
2. Clip the SpO_2 sensor to test subject.
3. Verify a SpO_2 reading is displayed with a tolerance of ± 2 digits.
4. Verify the SpO_2 waveform is printed on the printout.
5. Verify the SpO_2 alarm operation.

Safety Tests

WARNING: Explosion or Shock Hazard.
Before performing any test, read and follow all safety instructions for the test equipment indicated.

WARNING: Explosion or Shock Hazard.
The following instructions are written for the test equipment indicated. Performing any test with equipment other than the specific brand and model indicated may cause explosion, electrical shock, and equipment damage.

All safety tests are required whenever the case is opened, regardless of the type of maintenance or service performed. Safety tests include:

- Hipot Test
- Leakage Current Test

Note: If the Hipot and Leakage current tests in this section cannot be performed for any reason, perform the Alternate Safety Test Procedures starting on page 75.

Hipot Test

WARNING: Explosion Hazard.
Internal damage or improper assembly could cause an internal component to explode during Hipot testing. To minimize risk

- Ensure all Responder 2000 covers are in place and securely attached before testing
- Use appropriate personal safety equipment, including a face shield and gloves
- Ensure the area is clear before starting the test.

WARNING: Shock Hazard.
Do not touch the Hipot tester, the Responder 2000, or any leads during the test. Ensure all Hipot leads are electrically isolated before starting the test. If the test is performed on an anti-static mat, ensure the leads do not contact the mat during the test.

Required Equipment

- UadTech Sentry 30 AC/DC/IR Hipot Tester
- Test fixtures
  - ECG Connector Test Fixture. ECG connector with all leads and ground shield shorted together.
  - AC Plug Test Fixture. AC connector with line and neutral shorted together.
  - SpO_2 Connector Test Fixture. Connection for the ground shield.
  - ECG Paddle Test Fixture. Apex and Sternum pins shorted together.
  - Serial Port Test Fixture. Serial port connector with single lead connect to pin 5.

ECG to Serial 4.0 KVAC Test

1. Setup the Hipot tester:
   - 4.0 KVAC
   - High current limit 4.0 mA
   - Test 30 Sec.: Ramp 2.0 Sec.
   - 120 VAC (±10 %) Input
2. Plug in the ECG Connector Test Fixture into the ECG port.
3. Plug the Serial Port Test Fixture into the Serial port.
4. Connect the red hipot tester lead to the ECG Connector Test Fixture lead.
5. Connect the black hipot tested lead to the Serial Port Test Fixture lead.

WARNING: Shock Hazard.
Before starting the test, ensure all lead connections are electrically isolated.

6. Press **Start** (green button) on the Hipot tester. The test will take approximately 30 seconds.
   - If the test passes (short beep and green Pass LED is lit), continue with the next test.
   - If the test fails (audible alarm and red Fail LED is lit) discontinue testing. The unit must be returned to the manufacturer for troubleshooting and repair.

AC Line/Neutral to AC Ground 1.5 KVAC Test

1. Setup the Hipot tester:
   - 1.5 KVAC
   - High current limit 4.0 mA
   - Test 30 Sec.: Ramp 2.0 Sec.
   - 120 VAC (±10 %) Input
2. Plug in the AC Plug Test Fixture to the AC input connector.
3. Connect the red hipot tester lead to the AC Plug Test Fixture Line and Neutral lead.
4. Connect the black hipot tested lead to the AC Plug Test Fixture Ground lead.

WARNING: Shock Hazard.
Before starting the test, ensure all lead connections are electrically isolated.

5. Press **Start** (green button) on the Hipot tester. The test will take approximately two minutes.
   - If the test passes (short beep and green Pass LED is lit), continue with the next test.
   - If the test fails (audible alarm and red Fail LED is lit) discontinue testing. The unit must be returned to the manufacturer for troubleshooting and repair.

ECG to SpO_2 1.5 KVAC Test

Note: This test is only performed on models with the SpO_2 option installed.

1. Setup the Hipot tester:
   - 1.5 KVAC
   - High current limit 4.0 mA
   - Test 30 Sec.: Ramp 2.0 Sec.
   - 120 VAC (±10 %) Input
2. Plug in the ECG Connector Test Fixture into the ECG port.
3. Plug the SpO_2 Test Fixture into the Serial port.
4. Connect the red hipot tester lead to the SpO_2 Test Fixture lead.
5. Connect the black hipot tested lead to Serial Port Test Fixture lead.

WARNING: Shock Hazard.
Before starting the test, ensure all lead connections are electrically isolated.

6. Press **Start** (green button) on the Hipot tester. The test will take approximately two minutes.
   - If the test passes (short beep and green Pass LED is lit), continue with the next test.
   - If the test fails (audible alarm and red Fail LED is lit) discontinue testing. The unit must be returned to the manufacturer for troubleshooting and repair.

Apex Test Load to Apex and Sternum 3.0 KVDC Test

Note: The previous test settings were testing DC voltage. This test procedure requires setup for AC voltage.

1. Setup the Hipot tester:
   - 3.0 KVAC
   - High current limit 2.0 mA
   - Test 30 Sec.: Ramp 2.0 Sec.
   - 120 VAC (±10 %) Input
2. Plug in the Apex and Sternum Test Fixture to the ECG Paddle Connector.
3. Connect the red hipot tester lead to the Apex and Sternum load test lead.
4. Connect the black hipot tester lead to the Apex and Sternum lead.

WARNING: Shock Hazard.
Before starting the test, ensure all lead connections are electrically isolated.

5. Press **Start** (green button) on the Hipot tester. The test will take approximately two minutes.
   - If the test passes (short beep and green Pass LED is lit), continue with the next test.
   - If the test fails (audible alarm and red Fail LED is lit) discontinue testing. The unit must be returned to the manufacturer for troubleshooting and repair.

ECG to Apex and Sternum 3.0 KVDC Test

1. Setup the Hipot tester:
   - 3.0 KVAC
   - High current limit 2.0 mA
   - Test 30 Sec.: Ramp 2.0 Sec.
   - 120 VAC (±10 %) Input
2. Plug in the ECG Connector test fixture.
3. Plug in the Apex and Sternum Test Fixture to the ECG Paddle Connector.
4. Connect the red hipot tester lead to ECG Connector Test Fixture lead.
5. Connect the black hipot tester lead to the Apex and Sternum lead.

WARNING: Shock Hazard.
Before starting the test, ensure all lead connections are electrically isolated.

6. Press **Start** (green button) on the Hipot tester. The test will take approximately two minutes.
   - If the test passes (short beep and green Pass LED is lit), continue with the next test.
   - If the test fails (audible alarm and red Fail LED is lit) discontinue testing. The unit must be returned to the manufacturer for troubleshooting and repair.

Apex and Sternum to Service Port 3.0 KVAC Test

1. Setup the Hipot tester:
   - 3.0 KVAC
   - High current limit 2.0 mA
   - Test 30 Sec.: Ramp 2.0 Sec.
   - 120 VAC (±10 %) Input
2. Plug in the Apex and Sternum Test Fixture to the ECG Paddle Connector.
3. Plug in the Service Port Connector test fixture.
4. Connect the red hipot tester lead to ECG Connector Test Fixture lead.
5. Connect the black hipot tester lead to the Serial Port Connector Test lead.

WARNING: Shock Hazard.
Before starting the test, ensure all lead connections are electrically isolated.

6. Press **Start** (green button) on the Hipot tester. The test will take approximately two minutes.
   - If the test passes (short beep and green Pass LED is lit), continue with the next test.
   - If the test fails (audible alarm and red Fail LED is lit) discontinue testing. The unit must be returned to the manufacturer for troubleshooting and repair.

Leakage Current Test

Required Equipment

- Metron QA-90 Safety Analyzer (or equivalent)

Equipment Setup

Note: This setup assumes the use of a Metron QA-90 Safety Analyzer. If an equivalent safety analyzer is used, refer to the Operator's manual for detailed instructions.

1. Configure the Safety analyzer for following parameters.

Note: The following parameters may be saved for future use.

Leads	Name	Limit
	Earth Leakage Current (OS)	1000 µA
	Earth Leakage Current (NC)	500 µA
	Earth Leakage Current (OSRM)	1000 µA
	Earth Leakage Current (NCRM)	500 µA
	Enclosure Leakage Current (OS)	500 µA
	Enclosure Leakage Current (NC)	100 µA
	Enclosure Leakage Current (OE)	5000 µA
	Enclosure Leakage Current (OSRM)	500 µA
	Enclosure Leakage Current (NCRM)	100 µA
	Enclosure Leakage Current (OERM)	500 µA
1-2	Patient Leakage Current AC (OS)	50 µA
1-2	Patient Leakage Current AC (NC)	10 µA
1-2	Patient Leakage Current AC (OE)	50 µA
1-2	Patient Leakage Current AC (OSRM)	50 µA
1-2	Patient Leakage Current AC (NCRM)	10 µA
1-2	Patient Leakage Current AC (OERM)	50 µA
3-7	Patient Leakage Current AC (OS)	50 µA
3-7	Patient Leakage Current AC (NC)	10 µA
3-7	Patient Leakage Current AC (OE)	50 µA
3-7	Patient Leakage Current AC (OSRM)	50 µA
3-7	Patient Leakage Current AC NCRM	10 µA
3-7	Patient Leakage Current AC OERM	50 µA

Leads	Name	Limit
8	Patient Leakage Current AC (OS)	500 µA
8	Patient Leakage Current AC (NC)	100 µA
8	Patient Leakage Current AC (OE)	500 µA
8	Patient Leakage Current AC OSRM	500 µA
8	Patient Leakage Current AC NCRM	100 µA
8	Patient Leakage Current AC OERM	500 µA
1-2	Patient Auxiliary Current AC (OS)	50 µA
1-2	Patient Auxiliary Current AC NC	10 µA
1-2	Patient Auxiliary Current AC OE	50 µA
1-2	Patient Auxiliary Current AC OSRM	50 µA
1-2	Patient Auxiliary Current AC NCRM	10 µA
1-2	Patient Auxiliary Current AC OERM	50 µA
3-7	Patient Auxiliary Current AC (OS)	50 µA
3-7	Patient Auxiliary Current AC (NC)	10 µA
3-7	Patient Auxiliary Current AC (OE)	50 µA
3-7	Patient Auxiliary Current AC OSRM	50 µA
3-7	Patient Auxiliary Current AC NCRM	10 µA
3-7	Patient Auxiliary Current AC OERM	50 µA
1-2	Mains on Applied Part (SFC)	50 µA
1-2	Mains on Applied Part (SFCRM)	50 µA
3-7	Mains on Applied Part SFC	50 µA
3-7	Mains on Applied Part SFCRM	50 µA
8	Mains on Applied Part SFC	5000 µA
8	Mains on Applied Part SFCRM	5000 µA
1-2	Patient Leakage Current DC (OS)	50 µA
1-2	Patient Leakage Current DC (NC)	10 µA
1-2	Patient Leakage Current DC (OE)	50 µA
1-2	Patient Auxiliary Current DC OSRM	50 µA
1-2	Patient Auxiliary Current DC NCRM	10 µA
1-2	Patient Auxiliary Current DC OERM	50 µA

Leads	Name	Limit
3-7	Patient Auxiliary Current DC (OS)	50 µA
3-7	Patient Auxiliary Current DC (NC)	10 µA
3-7	Patient Auxiliary Current DC OE	50 µA
3-7	Patient Auxiliary Current DC OSRM	50 µA
3-7	Patient Auxiliary Current DC NCRM	10 µA
3-7	Patient Auxiliary Current DC OERM	50 µA
1-2	Patient Leakage Current DC (OS)	50 µA
1-2	Patient Leakage Current DC NC	10 µA
1-2	Patient Leakage Current DC OE	50 µA
1-2	Patient Leakage Current DC OSRM	50 µA
1-2	Patient Leakage Current DC NCRM	10 µA
1-2	Patient Leakage Current DC OERM	50 µA
3-7	Patient Leakage Current DC (OS)	50 µA
3-7	Patient Leakage Current DC (NC)	10 µA
3-7	Patient Leakage Current DC OE	50 µA
3-7	Patient Leakage Current DC OSRM	50 µA
3-7	Patient Leakage Current DC NCRM	10 µA
3-7	Patient Leakage Current DC OERM	50 µA
8	Patient Leakage Current DC (OS)	50 µA
8	Patient Leakage Current DC (NC)	10 µA
8	Patient Leakage Current DC OE	50 µA
8	Patient Leakage Current DC OSRM	50 µA
8	Patient Leakage Current DC NCRM	10 µA
8	Patient Leakage Current DC OERM	50 µA

2. Plug Cord from 120V, 60hz receptacle of Safety Analyzer into the wall outlet.
3. Plug cord from **Auxiliary Power to Equipment Under Test** receptacle of Safety Analyzer into Step-up transformer output (264VAC).
4. Plug power cord from Responder 2000 into outlet on front of Safety Analyzer.
5. Plug jumper cable from **ENCL** connector to **EARTH** connector.
6. Plug the 5 ECG cable leads from ECG Cable Port into **Patient Lead** connectors **3**-**7**.
7. Plug cable from Dfib Paddle Port into **Patient Lead** connectors **1** and **2**.
8. (For SpO_2 equipped Responder 2000 only) Plug cable from Sp02 connector to **Patient Lead** connector 8.

Test Procedure

Note: This procedure assumes the use of a Metron QA-90 Safety Analyzer. If an equivalent safety analyzer is used, refer to the Operator's manual for detailed instructions.

1. Press Responder 2000 **Power** button to turn on.
2. Turn on the Safety Analyzer and wait for the self test to complete.
3. If previously saved, select the stored Responder 2000 parameters.
4. Press **START** on the Safety Analyzer to begin the tests.
5. After test sequence is complete, verify TEST PASSED is displayed on the Safety Analyzer.

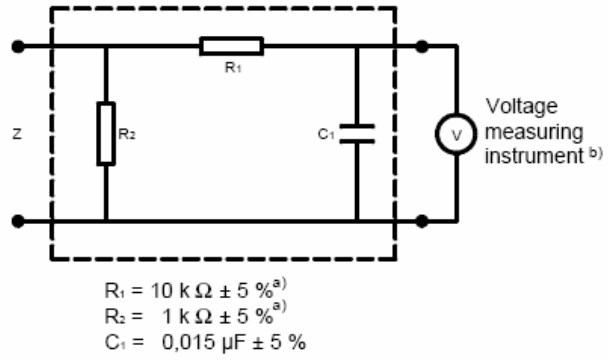
Alternate Safety Test Procedures

The following procedures are provided in case the recommended test procedures (above) cannot be performed.

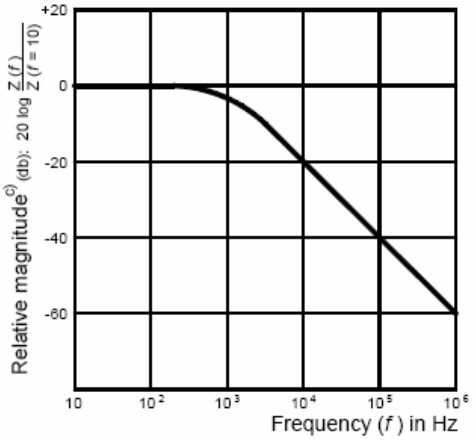
Test Equipment

Number	Equipment Description	Qty
	Fluke Model Index 2 Sp02 simulator	1
	Fluke Model ECG Simulator Defib analyzer or adequate	1
	Metron QA-90 Safety Analyzer or adequate	1
MarqIII-Kit	Marq-3 EKG Simulator or adequate	1
2025269-003	RESPONDER 2000/PH ECD PACER TESTER	1

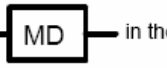
Leakage Current "Measurement Device" (MD) Characteristics



a) Measuring device



b) Frequency characteristics

NOTE The network and voltage measuring instrument above are replaced by the symbol 

in the following figures.

a) Non-inductive components
b) Resistance ≥ 1 MΩ and capacitance ≤ 150 pF
c) Z(*f*) is the transfer impedance of the network, i.e. V_{out}/I_{in}, for a current of frequency *f*.

To perform the leakage current measurements, the unit under test (UUT) or device under test (DUT) has to be separated from any interconnection to a system. If the UUT is part of a system, extended tests according to IEC 60601-1-1 have to be performed. The figure above shows the Measuring Device (MD) circuit required for leakage current. The reading in mV corresponds to µA (leakage current). The Safety Testers generally work with this MD circuit and the displayed values are already converted to leakage current.

Tests

The "Electrical Safety" tests may be performed under normal ambient conditions of temperature, humidity and pressure and line voltage. Use test "Devices" or "Measuring Devices" as shown or equivalent.

Visual Inspection

Verify instrument and accessories to ensure that;

- Fuse links have the rating proclaimed by the manufacturer
- Safety labels and inscriptions on the device are clearly legible
- The mechanical condition will allow the device to be put to further use
- Any soiling has no effect on safety of operation.

The defibrillator electrodes as well as handles and holder recesses must be free of any cream residue.

The defibrillator electrodes, pacemaker cable, ECG cable, SPO_2 cable and Responder 2000 power cord should be checked for any visible external damage to the insulation and strain relief.

Leakage Current

The leakage currents correspond to 110 % of rated voltage for the tested unit. Most Safety Testers take this into account; otherwise the measured values have to be calculated.

- Use of a “Safety Tester” as show or equivalent test setup (i.e. equivalent test configurations need not require/use S4).
- Ensure the “Safety Tester” and UUT are configured (if applicable) for the correct voltage.
- Connect the MD (Measuring Device) to the applicable ports on the “Safety Tester” or equivalent test points per measurement.
- Connect the “Safety Tester” to the mains supply.
- Connect the unit under test to your Safety Tester.

See section 0 for required measuring device circuit and characteristics.

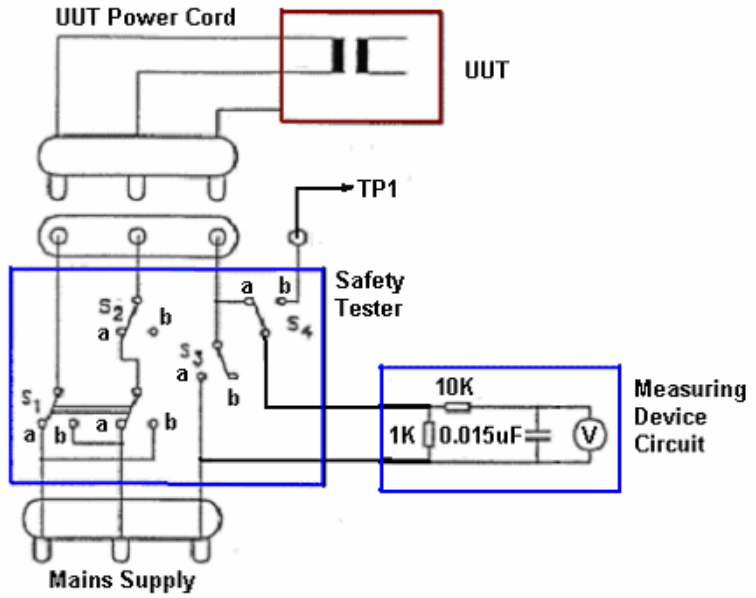


Figure 69: Basic measurement configuration

Earth leakage (AC Line)

Perform the following tests, with the applicable switch settings on the “Safety Tester” and record the results in the applicable test form(s).

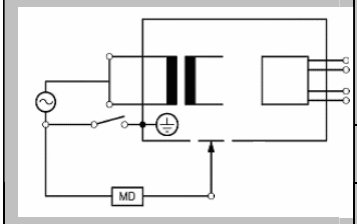
- UUT power switch in the “ON” position.

Test Description	S1: DPDT Polarity a) Normal b) Reverse		S2: SPDT Neutral a) Closed b) Open		S3: SPDT Ground a) Closed b) Open		S4: SPDT Test point a) Internal b) TP1		Maximum Limits (uA)	
	Position		Position		Position		Position			
	a	b	a	b	a	b	a	b	EN/IEC	UL
Earth leakage current measurements TP1 – no connection										
Polarity: Normal Neutral: Normal (Closed) Ground: Open	X		X			X	X		500	300
Polarity: Normal Neutral: Open Ground: Open	X			X		X	X		1,000	1,000
Polarity: Reverse Neutral: Open Ground: Open		X		X		X	X		1,000	1,000
Polarity: Reverse Neutral: Normal (Closed) Ground: Open		X	X			X	X		500	300

Enclosure (Chassis) leakage

Perform the following tests, with the applicable switch settings on the “Safety Tester” and record the results in the applicable test form(s).

- UUT power switch in the “ON” position.
- TP1 connected to accessible metal parts (see tables below for individual test points).

Test Description 	S1: DPDT Polarity a) Normal b) Reverse		S2: SPDT Neutral a) Closed b) Open		S3: SPDT Ground a) Closed b) Open		S4: SPDT Test point a) Internal b) TP1		Maximum Limits (uA)	
	Position		Position		Position		Position			
	a	b	a	b	a	b	a	b	EN/IEC	UL
Enclosure (Chassis) leakage current measurements: **TP1 connected to “RS-232 DB9 shell and Metal part of Printer.**										
Polarity: Normal Neutral: Normal (Closed) Ground: Normal (Closed)	X		X		X			X	100	100
Polarity: Normal Neutral: Open Ground: Normal (Closed)	X			X	X			X	500	300
Polarity: Normal Neutral: Normal (Closed) Ground: Open	X		X			X		X	500	300
Polarity: Reverse Neutral: Normal (Closed) Ground: Open		X	X			X		X	500	300
Polarity: Reverse Neutral: Open Ground: Normal (Closed)		X		X	X			X	500	300
Polarity: Reverse Neutral: Normal (Closed) Ground: Normal (Closed)		X	X		X			X	100	100

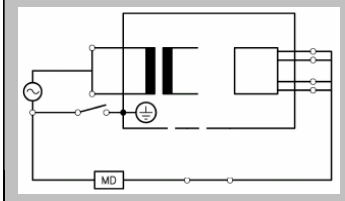
Patient Leakage Current to Ground

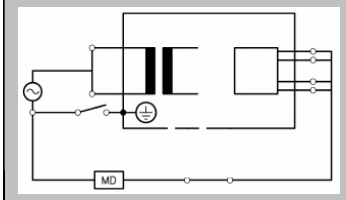
Perform the following tests, with the applicable switch settings on the “Safety Tester” and record the results in the applicable test form(s).

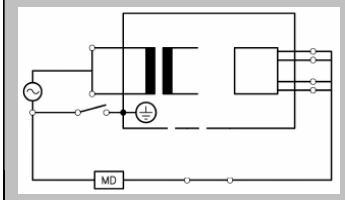
- UUT power switch in the “ON” position.
- TP1 connected to “Applied Parts” (see tables below for individual test points).

Note: The following applied parts have a separate isolated input and have to be tested separately.

- Leads
- Paddles
- SpO_2

Test Description 	S1: DPDT Polarity a) Normal b) Reverse		S2: SPDT Neutral a) Closed b) Open		S3: SPDT Ground a) Closed b) Open		S4: SPDT Test point a) Internal b) TP1		Maximum Limits (uA)	
	Position		Position		Position		Position			
	a	b	a	b	a	b	a	b	EN/IEC	UL
Patient leakage current measurements: LEADS **TP1 connected to “LEADS” (all LEADS connected together), Type CF defibrillation proof limits**										
Polarity: Normal Neutral: Normal (Closed) Ground: Normal (Closed)	X		X		X			X	10	10
Polarity: Normal Neutral: Open Ground: Normal (Closed)	X			X	X			X	50	50
Polarity: Normal Neutral: Normal (Closed) Ground: Open	X		X			X		X	50	50
Polarity: Reverse Neutral: Normal (Closed) Ground: Open		X	X			X		X	50	50
Polarity: Reverse Neutral: Open Ground: Normal (Closed)		X		X	X			X	50	50

Test Description 	S1: DPDT Polarity a) Normal b) Reverse		S2: SPDT Neutral a) Closed b) Open		S3: SPDT Ground a) Closed b) Open		S4: SPDT Test point a) Internal b) TP1		Maximum Limits (uA)	
	Position		Position		Position		Position			
	a	b	a	b	a	b	a	b	EN/IEC	UL
Polarity: Reverse Neutral: Normal (Closed) Ground: Normal (Closed)		X	X		X			X	10	10
Patient leakage current measurements: PADDLES **TP1 connected to "PADDLES" (all PADDLES connections tied together), Type CF defibrillation proof limits**										
Polarity: Normal Neutral: Normal (Closed) Ground: Normal (Closed)	X		X		X			X	10	10
Polarity: Normal Neutral: Open Ground: Normal (Closed)	X			X	X			X	50	50
Polarity: Normal Neutral: Normal (Closed) Ground: Open	X		X			X		X	50	50
Polarity: Reverse Neutral: Normal (Closed) Ground: Open		X	X			X		X	50	50
Polarity: Reverse Neutral: Open Ground: Normal (Closed)		X		X	X			X	50	50
Polarity: Reverse Neutral: Normal (Closed) Ground: Normal (Closed)		X	X		X			X	10	10

Test Description 	S1: DPDT Polarity a) Normal b) Reverse		S2: SPDT Neutral a) Closed b) Open		S3: SPDT Ground a) Closed b) Open		S4: SPDT Test point a) Internal b) TP1		Maximum Limits (uA)	
	Position		Position		Position		Position			
	a	b	a	b	a	b	a	b	EN/IEC	UL
Patient leakage current measurements: SpO_2 **TP1 connected to "SpO_2" (all SpO_2 connections tied together), Type BF defibrillation proof limits**										
Polarity: Normal Neutral: Normal (Closed) Ground: Normal (Closed)	X		X		X			X	100	100
Polarity: Normal Neutral: Open Ground: Normal (Closed)	X			X	X			X	500	500
Polarity: Normal Neutral: Normal (Closed) Ground: Open	X		X			X		X	500	500
Polarity: Reverse Neutral: Normal (Closed) Ground: Open		X	X			X		X	500	500
Polarity: Reverse Neutral: Open Ground: Normal (Closed)		X		X	X			X	500	500
Polarity: Reverse Neutral: Normal (Closed) Ground: Normal (Closed)		X	X		X			X	100	100

Patient Leakage Current, Mains on Applied Part (All SIP/SOPs Grounded)

Perform the following tests, with the applicable switch settings on the “Safety Tester” and record the results in the applicable test form(s).

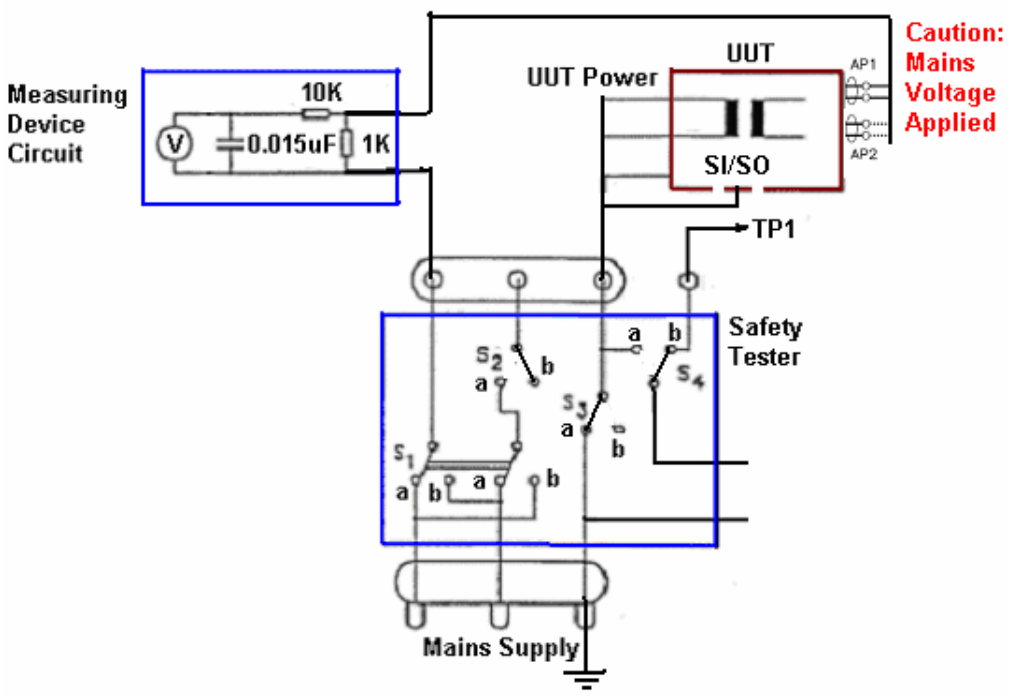
1. Disconnect the “Safety Tester” from the “Mains Supply”
2. Ensure the battery is removed
3. Configure the test set up as shown (or equivalent)
   - UUT hot/neutral/ground connected to ground
   - All accessible metal parts (i.e. DB9 shell and exposed metal of printer) connected to ground
4. UUT power switch in the “ON” position.

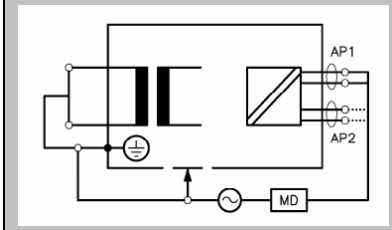
Caution:
Use care when connecting the “Safety Tester” to the “Mains Supply”, mains voltage will appear on the applied parts.

Caution:
Use care when selecting switch settings (S2 should be open, S3 = safety ground)

Note: The following applied parts have a separate isolated input and have to be tested separately.

- Leads
- Paddles
- SpO_2



Test Description	S1: DPDT Polarity a) Normal b) Reverse		S2: SPDT Neutral a) Closed b) Open		S3: SPDT Ground a) Closed b) Open		S4: SPDT Test point a) Internal b) TP1		Maximum Limits (uA)	
	Position		Position		Position		Position			
	a	b	a	b	a	b	a	b	EN/IEC	UL
Patient leakage current, Mains on Applied Part (All SIP/SOPs Grounded): LEADS **MD connected to "LEADS" (all LEADS connected together), Type CF defibrillation proof limits** **Caution: mains voltage on "LEADS"**										
Polarity: Normal Neutral: Open Ground: Normal (Closed)	X			X	X			X	50	50
Polarity: Reverse Neutral: Open Ground: Normal (Closed)		X		X	X			X	50	50
Patient leakage current, Mains on Applied Part (All SIP/SOPs Grounded): PADDLES **MD connected to "PADDLES" (all PADDLES connections tied together), Type CF defibrillation proof limits** **Caution: mains voltage on "PADDLES"**										
Polarity: Normal Neutral: Open Ground: Normal (Closed)	X			X	X			X	100 (60601-2-4)	50
Polarity: Reverse Neutral: Open Ground: Normal (Closed)		X		X	X			X	100 (60601-2-4)	50
Patient leakage current, Mains on Applied Part (All SIP/SOPs Grounded): SpO_2 **MD connected to "SpO_2" (all SpO_2 connections tied together), Type BF defibrillation proof limits** **Caution: mains voltage on "SpO_2"**										
Polarity: Normal Neutral: Open Ground: Normal (Closed)	X			X	X			X	5,000	5,000
Polarity: Reverse Neutral: Open Ground: Normal (Closed)		X		X	X			X	5,000	5,000

Insulation Resistance

Perform the following tests, with the applicable resistance range settings and record the results in the applicable test form(s).

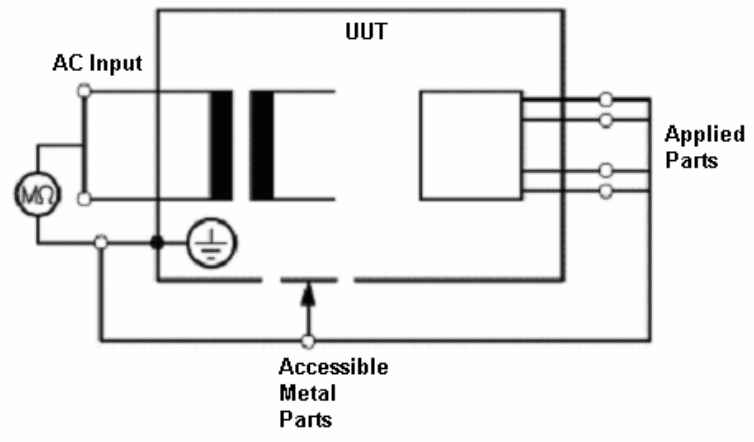
1. Disconnect from the SUPPLY MAINS
2. Remove battery
3. Remove I/O (RS-232) cable
4. UUT power switch in the “ON” position.

The resistance values shall not be less than:

- 2 MΩ between MAINS PART and all other parts separated by basic insulation, including TYPE B APPLIED PARTS
- 7 MΩ between MAINS PART and all other parts separated by double insulation, including TYPE B APPLIED PARTS
- 70 MΩ between MAINS PART to any F-TYPE APPLIED PART

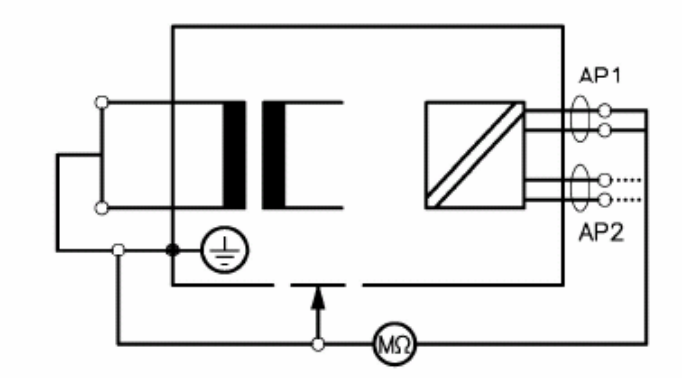
Accessible Metal Parts Insulation Resistance

- The resistance value shall not be less than: 7 MΩ



MAINS PART to “F-TYPE APPLIED PARTS” insulation resistance

- The resistance value shall not be less than: 70 MΩ



SECTION 6: Parts and Accessories

To order service parts for the responder 2000, contact:

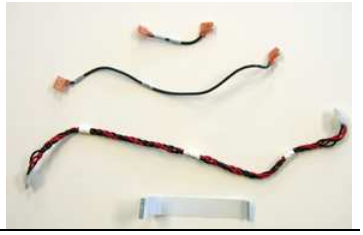
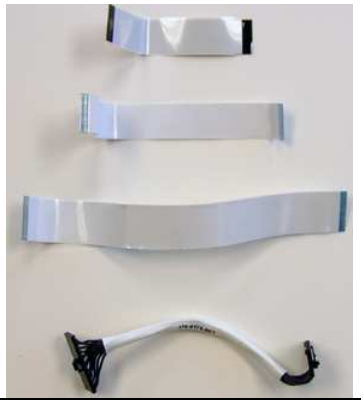
GE Healthcare Technologies Service Logistic Center
79111 Freiburg
Munzinger Straße 3-5
Germany

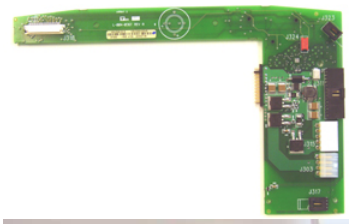
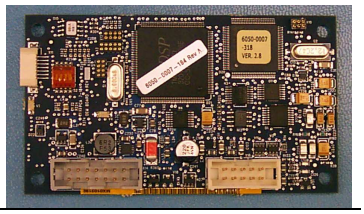
Overview

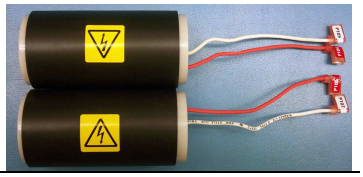
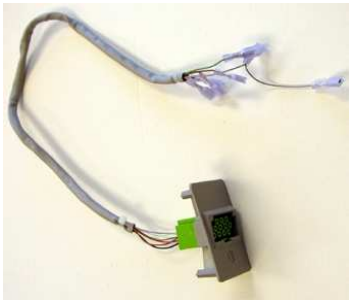
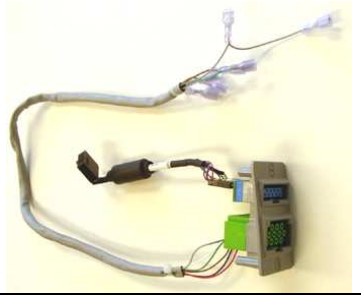
This section lists parts and accessories for the Responder 2000.

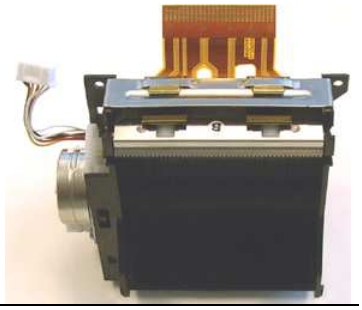
TOPIC	PAGE
Kits	87
Accessories	92
Power Cords	94

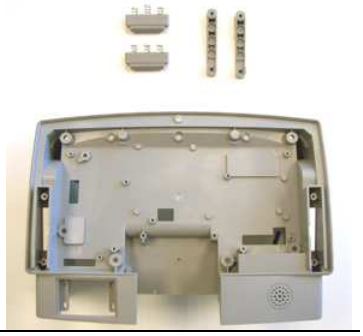
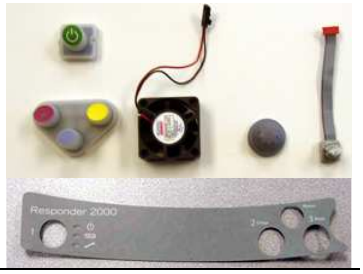
Kits

Kit Part Number	*Kit Description*	*Part Photograph*
2029882-001 **Therapy Board** with Cables **2029882-002** **Therapy Board** Cables Only	**Therapy Board Kit** 1. **Therapy Board** 2. Left Drain Cable 3. Right Drain Cable 4. **Therapy Board** to Power Control Board Cable 5. **Therapy Board** to Main Board Ribbon Cable	 
2029882-003 Main Board basic with Cables (For models 2025653-xxx) **2029882-004** Main Board pacer with cables (For models 2026109-xxx) **2029882-005** Main Board Pacer/SpO_2 with cables (For Models 2026114-xxx) **2029882-006** Main Board Cables Only	**Main Board Kit** 1. Main Board 2. Main Board to Printer Ribbon Cable 3. Power Control Board to Main Board Ribbon Cable 4. Power Control Board to Main Board Ribbon Cable 5. Power Control Board to Main Board Cable	 

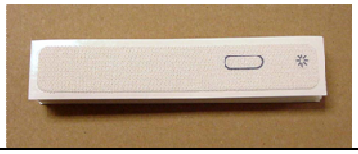
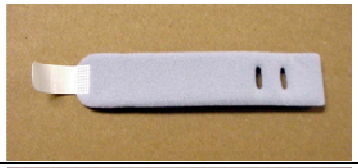
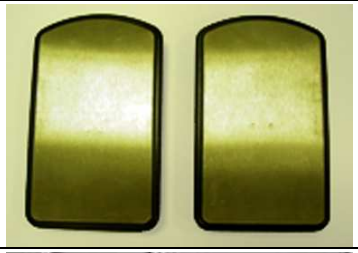
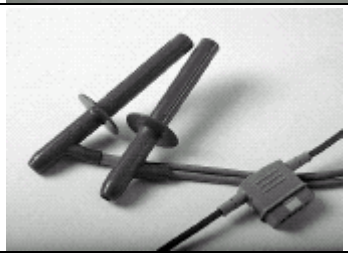
Kit Part Number	*Kit Description*	*Part Photograph*
2029882-008 Power Control Board and Cables **2029882-009** Wire Set for Power Control Board	**Power Control Board Kit** 1. Power Control Board 2. Service Connector (with Cable) 3. Power Control Board Main Board Cable 4. Power Control Board to **Therapy Board** Cable 5. Power Control Board to Main Board Ribbon Cable	
2029882-007 Power Supply Kit	**Power Supply Kit** Power Supply	
2029882-010 **ECG Board** with Isolation Shield	**ECG Board Kit** 1. ECG Board Insulator 2. ECG Board EMF Cover 3. **ECG Board**	
2029882-011 SpO_2 Board Kit	**SpO_2 Board Kit** SpO_2 Board	

Kit Part Number	*Kit Description*	*Part Photograph*
2029882-012 High Voltage Capacitor Set	**Main Capacitors Kit** Main Capacitors (2)	
2029882-013 Rear Cover with Defib Connector **2029882-016** Device Handle Only **2029882-017** Bed Rail Hook Covers Only	**Rear Cover Kit** 1. Rear Cover (Including Paddle Cables and Paddle Wires) 2. Handle 3. Bed Rail Hook Covers 4. Rear Cover Label	
2029882-015 ECG Input Connector, wired	**ECG Cable Kit** ECG Connector and Cable	
2029882-014 ECG/SpO_2 Input Connector wired	**ECG/SpO_2 Cable Kit** ECG/SpO_2 Connectors and Cables	

Kit Part Number	*Kit Description*	*Part Photograph*
2029882-018 LCD Set with Retainer **2029882-019** LCD Retainer only	**Display Kit** 1. Display Retainer 2. Copper Contact Spring 3. Display Assembly (including Backlight cable) 4. Display to Main Board ribbon cable	
2029882-020 Printer Assembly	**Printer Kit** 1. Printer Assembly 2. Printer Roller (Not Shown)	
2029882-021 Printer Door Assembly	**Printer Door Kit** Printer Door **Note:** The printer door does not come with the Roller. The roller must be ordered as part of the Printer Kit.	
2029882-025 Base Cover Kit **2029882-022** Battery Release Kit (Includes Spring, Latch, and Release Only)	**Base Cover Kit** 1. Extension Spring 2. Battery Latch 3. Battery Release 4. Base Cover **Note:** This kit does not include a Front Label.	

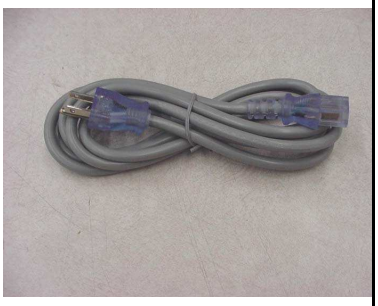
Kit Part Number	*Kit Description*	*Part Photograph*
2029882-023 Front Bezel Kit	**Front Bezel Kit** Front Bezel	
2029882-024 Front Body Kit	**Front Body Kit** 1. Paddle Latches (with Springs) (2) 2. Paddle Latches (2) 3. Front Body 4. Speaker (not shown) **Note:** Speaker is integral to Front Body and not available separately.	
2029882-026 Wear and Tear Kit	**Wear and Tear Kit** 1. Power Button Assembly 2. Charge, Manual, Shock Button Assembly 3. Fan 4. Encoder Cap 5. Encoder Button and Cable Assembly 6. Front Label	
2029882-027 Hardware Starter Kit **2029882-028** Tube of Silicone Sealant	**Hardware Starter Kit** Includes supply of screws, washers, silicone tubing, silicone sealant, rubber grommets, cable ties, screw drivers, and a communications cable.	
2036667-001 Service Stickers	**Service Stickers** Includes a roll of 500 tamper proof service stickers	

Accessories

Accessory Part Number	*Part Description*	*Part Photograph*
OXY-RWL Datex-Ohmeda Foam Wrap	**Datex-Ohmeda Replacement Large Foam Wrap**	
OXY-RTW Datex-Ohmeda Wide Adhesive Tape	**Datex-Ohmeda Replacement Wide Adhesive Tape**	
2030137-001 Paddle Pair, Responder	**Paddles with two adult surface plates**	
2030134-001 Adapter Electrode Paddle Responder	**Responder Paddle Electrode Adaptors**	
2030247-001 Cable Interconnection Responder Electrode/Pad	**Responder Electrode/Pad Cable Interconnection**	
2030249-001 Electrode Pair Responder Internal	**Responder Internal Electrode Pair**	

Accessory Part Number	*Part Description*	*Part Photograph*
2026327-001 Thermal Paper	**60-mm Thermal Paper (Box of 50)**	
2025267-001 Rechargeable Battery	**Rechargeable Battery**	

Power Cords

Europe	*Argentina*	*Denmark*
2020387-002	*2020387-003*	*2020387-004*
India and South Africa	***Italy***	***Japan***
2020387-005	***2020387-006***	***2020387-007***
		
UK	***Israel***	***Australia***
2020387-009	***2020387-010***	***2020387-011***

SECTION 7: Theory of Operation

Overview

This section provides descriptions of the Responder 2000 and its components. These instructions are intended for use only by service providers who are specifically trained to service the Responder 2000.

TOPIC	PAGE
System Overview	96
System Interconnection Block Diagram	97
Component Descriptions	98

System Overview

The Responder 2000 system has the following functions and features.

Note: Refer to the Operator's Manual for specific instructions and intended use.

Functions

Defibrillation (with dedicated Defibrillator operation buttons)
- 2J to 270J Biphasic waveform (can deliver 270J Biphasic shock into a 50 Ohm load)
- Paddle connector accepts pads, paddles, or spoons

Transcutaneous cardiac pacing
40ms rectilinear current source pace pulse, 0 to 140 mA, 0 to 180 PPM, demand and asynchronous modes
ECG Monitoring through therapy electrodes, paddles, or a separate five wire ECG input
Optional Pulse Oxymetry (GE506)

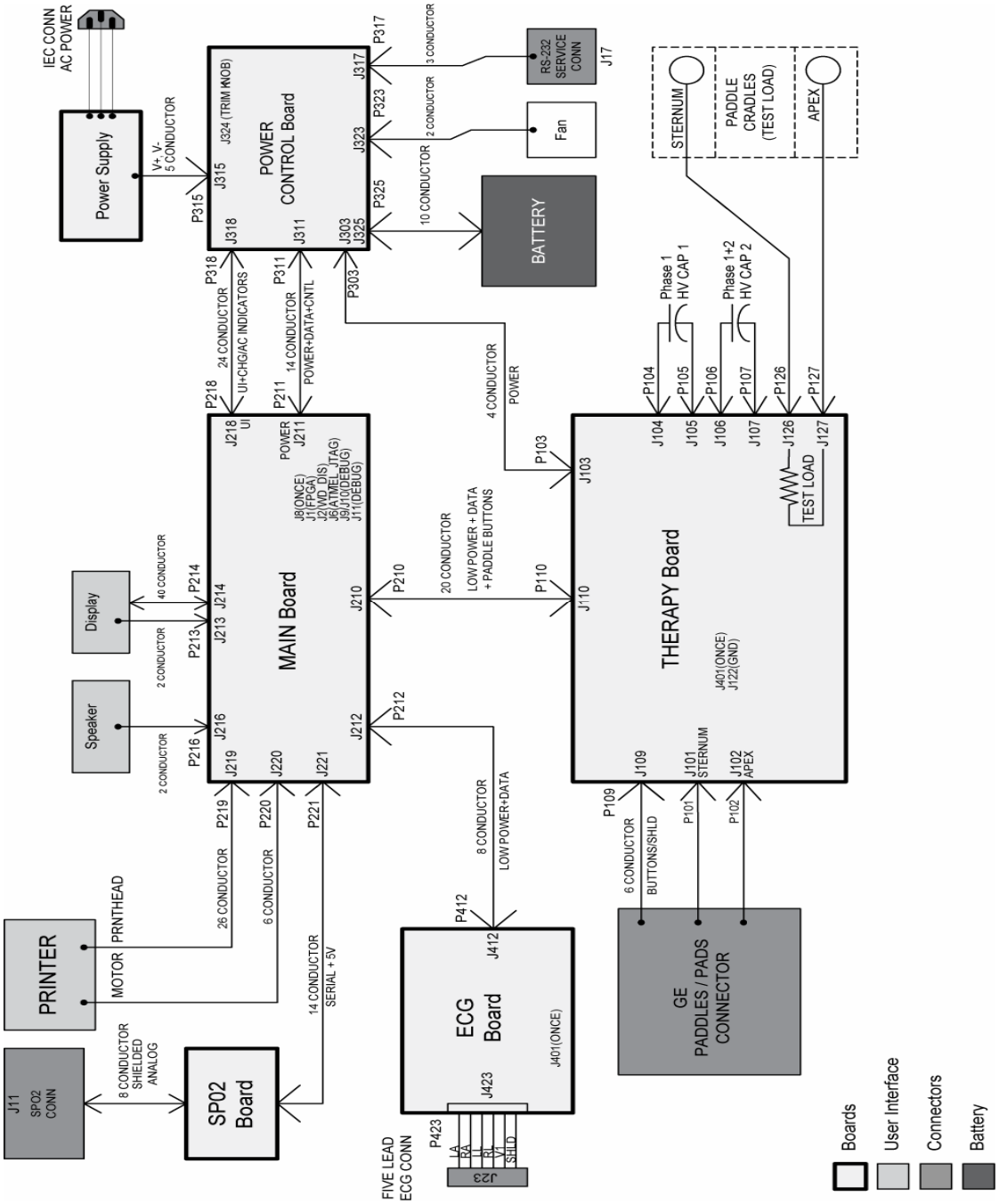
Features

Color LCD to display operational, ECG, and SPO_2 information
The display is 5.67", backlit, with a 320 x 240 resolution and over 260k colors
Trim knob for input via the display
Thermal printer for ECG, Pulse Oxymetry, Therapy Actions and Event history
- 384 pixel resolution at 25mm/s on a 60mm paper roll
- Prints in real-time two-trace graphic, text, and raster modes

AC or rechargeable battery operation
- AC: 90 VAC to 264 VAC, 47Hz-63Hz, 90 Watts Cont., 115 Watts intermittent
- Battery: Lithium Ion with built in charge indicator, delivers up to 10A at 11.0V (Nominal)

Internal Defibrillator and Pacer test load
Speaker for audible indication
Serial port for software upgrade

System Interconnection Block Diagram



Component Descriptions

Main Board

The Main Board controls all major subsystems and user interface.

Controls defibrillation (J210), pacing, ECG (J212), and SpO_2 (J221) functions
Controls the display interface and provides 3.3V (J214) and high voltage backlight power (J213) for LCD.
Controls (J219) and provides 5V (J220) for the Printer
Controls the speaker (J216)
Software upgrade path through the serial port (pass-through from the Power Control Board)

Therapy Board

The **Therapy Board** delivers energy for defibrillation and pacing. It is also a pass-through to the main board for controls, ID features on defibrillator paddles, and ECG signals. Specifics include:

3 kV electrical isolation to separate the patient from the unit and earth ground
Delivers up to 270J biphasic defibrillator shock (J101, J102, & J109)
Delivers up to 140mA 40ms pace pulses
Charges two 100uF Capacitors to 2 kV (J105 & J107 negative; J104 & J106 positive)
Connects to the Main Board (J110)
Receives power from the Power Control Board (J103)

ECG Board

The optional **ECG Board** receives input from ECG leads connected. The **ECG Board** then amplifies and digitizes the data and passes it on to the Main Board

4 kV electrical isolation to separate the patient from the unit and earth ground
Connects to the Main board (J412)
ECG Leads connect at J23

Power Control Board

The Power Control Board provides power to the unit (J303, J311), charges the battery (J325), and provides UI pass-through (J318). Specifics include:

Receives power from the Power Supply (J315)
Provides RS-232 service connection (J317)
Buttons connected to the Power Control board include: Power (on/off), Charge, Shock, Manual shock, and Trim knob (J324)
LEDs include: AC Power, Shock, Manual, Charge, Power, Fault, Battery Charge
Powers the Fan (J323).

SpO_2 Board

The optional SpO_2 board (P221) mounts to the Main board and patient SpO_2 sensor connection is directly to the SpO_2 module (J11).

SECTION 8: Specifications and Safety

Overview

This section presents the specifications and safety standards of the Responder 2000.

TOPIC	PAGE
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RHYTHMx® ECG Analysis Algorithm	102
STAR® BIPHASIC Defibrillation Waveform	104
Electromagnetic Compatibility Requirements	107
Environmental Standards	107
Electromagnetic Emissions Table	108
Electromagnetic Immunity Table	110
RF Communications Table	111
Connectors	114

Specifications

Display	
Size:	115.2mm X 86.4mm
Type:	Transmissive Color TFT LCD
Resolution:	320 X 240 pixels
Number of waveform channels:	2
Defibrillator	
Waveform:	Biphasic truncated exponential
Charge Time:	7 seconds nominal
Delivery Method:	Via pads, paddles or spoons
Paddles and Pads Energy Selections (50Ω load):	2, 3, 5, 7, 10, 15, 20, 30, 50, 70, 100, 150, 200, 270
Internal Paddle Energy Selections (50Ω load):	2, 3, 5, 7, 10, 15, 20, 30, 50
Energy Accuracy:	± 15% onto a 50Ω load or ± 3 Joules, whichever is greater
Non-Invasive Pacing	
Output Waveform:	Rectilinear, constant current
Delivery Method	Via Pads
Pulse Width:	40 milliseconds ±4mS
Pacing Modes:	Demand or Asynchronous (Fixed Rate)
Pacing Rate:	Operator adjustable: 30 to 180 ppm, ± 5%
Pacing Current:	0mA to 140mA
SPO_2	
Display	Plethysmogram, digital value of percent saturation, and upper and lower alarm limits.
Display Update Period	8 seconds or less
Saturation Range	1 to 100%, in 1% increments
Low Saturation Alarm	81-98% in 1% increments
High Saturation Alarm	Off, 95-100% in 1% increments
Pulse Rate Range	20 to 255 BPM, in 1 BPM increments
Audible Alarm Delay	10 seconds or less
Visual Alarm Delay	2 seconds or less
Pulse Rate Accuracy	30 to 250 bpm: ± 2 digits or ± 2%, whichever is greater (without motion) 30 to 250 bpm: ± 3 digits (during low perfusion)
Saturation Accuracy	+/- 2 digits from 70% SpO_2 to 100% SpO_2 with D-O probes, except +/- 3 digits for D-O Ear Probe. OEM board accuracy +/-3 digits from 70%
ECG Monitoring	

Detection Lead:	Through either 3-lead and 5-lead patient cable, pads, or paddles
Lead Selection:	3-Lead Cable: (I, II, III) and 5-Lead (I, II, III, aVL, aVR, aVF, and V), PADS: (Modified Lead II)
Heart Rate Range:	25 to 300 bpm
Display Frequency Response (ECG Leads):	0.5 to 100 Hz (± 10 %)
Display Frequency Response (paddles):	3 Hz to 33 Hz (± 10 %); (-3db)
ECG Effective Sampling Rate:	1000 samples per second (ECG Leads), 128 samples per second (paddles)
Post Defibrillation Recovery:	8 seconds
Heart Rate Alarms:	Off, 5-300 bpm
Leads Off Sensing	DC current; Sensing Leads <0.1 uA; Reference Lead <1uA; when all leads are connected
ECG Leads and paddles leakage current	Less than 10uA in normal; Less than 50uA in single fault condition
Dynamic Range: Input ECG signal amplitude:	± 5mV
Dynamic Range: DC Offset voltage:	± 500 mV ECG from ECG cable; ± 1000 mV (ECG from pads, paddles and spoons
Asystole Threshold	0.2mV (±0.1mV)
Rechargeable Battery	
Battery Voltage:	11.1 V Nominal
Chemistry:	Lithium-ion
Compatibility:	Compatible with Responder 2000
Battery Capacity:	50 shocks, or 240 minutes monitoring time, or 72 minutes monitoring time with pacing
Battery Charge Time:	8 hours in Responder 2000, 4 hours in external charger, 20 hours for calibration cycle in external charger
Battery Standby:	6 months
Battery Life:	2.5 years or 300 Battery charge-discharge cycles, whichever comes first
Battery Weight:	1 lb. 3 oz; .54 kg
AC Power Supply	
Universal input:	100V to 240V~ 50Hz-60Hz 200VA
Printer	
Speed	25 mm/S feed rate
Paper Size	60 mm paper width

Physical Dimensions

Height: 10.8 inches/27.4 cm
Width: 11.7 inches/29.7 cm
Depth: 7.4 inches/18.8 cm
Weight: Less than 10lbs/4.5kg, excluding battery, paddles, and a full roll of paper.

Environmental Requirements

Operating Conditions

Temperature: 0°C to 50°C (32 °F to 122°F)
Humidity: 10% to 95% RH, non condensing
Air Pressure altitude: -500 ft (103kPa) to 15000 ft (57kPa)

Storage and Shipping Conditions

Temperature (Responder 2000): -20°C to 60°C (-4°F to 140°F)
Temperature (Pads): -12°C to 43°C (10°F to 110°F) for 2 years.

NOTE: Do not exceed 38°C (100°F) for periods greater than 6 months in duration. Always store the pads in their pouch to maintain freshness. Do not use if gel has dried out.

Humidity: 10% - 95% RH, non-condensing
Air Pressure altitude: -500 ft (103kPa) to 15000 ft (57kPa)

WARNING:

Electrode performance may be adversely affected by pre-attaching and storing with defibrillator cable or exposure to air for long periods of time. These electrodes are not recommended for electrosurgery.

CAUTION: Environment of use

Responder 2000 is designed for indoor use. Operator must confirm that the environment of use meets the required operating environmental specifications before using.

CAUTION: Cold Environments

If the Responder 2000 is stored in an environment with a temperature below the operating temperature, the unit should be allowed to warm up to the needed operating temperature before using.

RHYTHMx® ECG Analysis Algorithm

The RHYTHMx® ECG analysis algorithm provides superior ECG detection capabilities. The features available with the Responder 2000 include the following:

- Detection Rate
- Asystole Threshold
- Noise Detection
- Non-Committed Shock
- Synchronized Shock
- SVT Discriminators
- Supraventricular Tachycardia (SVT) Rate
- Continuous Monitoring

The Responder 2000 rejects all T-waves that are 1 millivolt or less in the conditions specified in ANSI/AAMI EC 13 section 4.1.2.1c.

The Responder 2000 will alarm tachycardia in the conditions specified in ANSI/AAMI EC 13 section 4.1.2.1 g) in less than 10 seconds.

For the alternating ECG complexes specified in ANSI/AAMI EC 13 figure 3, the Responder 2000 will indicate the following heart rates:

Figure 3a 40 bpm
Figure 3b 52 bpm
Figure 3c 59 bpm
Figure 3d 122 bpm

(Refer to the ANSI/AAMI EC 13 for the figures.)

The following sections describe specific RHYTHMx® information.

Detection Rate

All ventricular fibrillation (VF) and ventricular tachycardia (VT) rhythms at or above this rate will be classified as shockable. All rhythms below this rate will be classified as non-shockable. This rate is configurable between 120 bpm (beats per minute) and 240 bpm. The default Detection Rate for the Responder 2000 is 160 bpm.

Fine VF

Fine VF is classified by the signal amplitude less than 0.2 mV peak-to-peak for eight (8) consecutive seconds, preceded by a shockable arrhythmia or the peak-to-peak amplitude less than 0.9 mV, the amplitude distribution indicator is less than amplitude distribution threshold, the derivative probability density function is satisfied, the RR interval index is not regular, and it is preceded by a shockable rhythm. Fine VF is a shockable arrhythmia.

Asystole

The signal amplitude is less than 0.2 mV peak-to-peak for 8 consecutive seconds and is not preceded by a shockable rhythm; the rhythm will be classified as Asystole. Asystole is not shockable.

Noise Detection

The Responder 2000 will detect noise artifact in the ECG. Noise could be introduced by excessive moving of the patient or electronic noise from external sources like cellular and radiotelephones.

Non-Committed Shock

After the Responder 2000 advises a shock, it continues to monitor the patient ECG rhythm. If the patient's rhythm changes to a non-shockable rhythm before the shock button is pressed, the shock will be cancelled.

Sync Mode

The Responder 2000 is designed to deliver synchronized shock on the R-wave for Sync Shock. The Responder 2000 will automatically attempt to synchronize a shock to the R-wave. If delivery cannot be synchronized within two seconds it will not deliver the shock. It is recommended to select/adjust to a lead with a unipolar R wave of about 1 mV peak amplitude for safe and reliable synchronization.

IEC 60601-2-4 (2002) and ANSI/AAMI DF 80 (2003), clause 104c states that the maximum delay from the "peak of the QRS" to the peak of the defibrillator output waveform shall be 60ms. Verification testing has shown that the Responder 2000 meets this requirement of the standards.

Some ECG leads may exhibit a bipolar QRS waveform complex, and in these cases, the RHYTHMx software in the Responder 2000 will pick the highest peak of the QRS complex for synchronization. The peak of the defibrillator output will occur in less than 60ms from this peak, and therefore the Responder 2000 meets the synchronization requirement of the standards.

In the case of these leads, certain defibrillator testers may use a different part of the QRS complex (for example the first, smaller peak) to measure synchronization time of defibrillation. This may give a measurement result that exceeds 60ms. Investigation has shown that the Responder 2000 does synchronize appropriately from the peak of the QRS complex, and meets the requirement of the standards in cases where a particular defibrillator tester does not measure the defibrillation delay from the peak of the QRS complex.

SVT (Supraventricular Tachycardia) Discriminators

The Responder 2000 is supplied with the SVT Discriminator enabled and the default setting is 240 bpm. SVT Discriminators are sophisticated filters that analyze the morphology of the ECG waveforms and distinguish VF/VT from SVT and Normal Sinus Rhythms (NSR). The SVT Discriminator will only be applied to rhythms that fall between the Detection Rate and the SVT Rate.

SVT Rate

All rhythms with rates between the Detection Rate and SVT Rate will be screened through a number of SVT Discriminators to classify them into VF/VT or SVT. Rhythms classified as SVT between the two set rates are not shockable. All rhythms above the rates will be classified as shockable. The SVT Rate must be greater than the Detection Rate and is selectable between 125 and 240 bpm. The default SVT rate is 240.

Continuous Monitoring For Shockable Rhythm

The Responder 2000 can monitor the ECG rhythms continuously.

Pacemaker Pulse Information

Pacemaker pulses without overshoot, in all of the conditions specified in ANSI/AAMI EC13 section 4.1.4.1, in the range of 20mV to 700mV and 0.1 milliseconds to 2 milliseconds wide, will be rejected by the Responder 2000.

Pacemaker pulses with overshoot, in all the conditions specified in ANSI/AAMI EC 13 section 4.1.4.2, in the range of 20mV to 700MmV and 0.1 milliseconds to 2 milliseconds wide, will be rejected by the Responder 2000.

The pacer pulse detector will not respond to the waveform of ANSI/AAMI figure 5d, since this waveform is below the threshold of the Responder 2000 pacer pulse detector. The minimum typical slew rate in V/s RTI that will trip the pacer detector is 6.2 V/s for the 3 and 5 lead ECG. The minimum typical slew rate in V/s RTI that will trip the pacer detector is 9.8 V/s for paddles.

STAR® BIPHASIC Defibrillation Waveform

The waveform generated by the Responder 2000 is a BIPHASIC TRUNCATED EXPONENTIAL waveform compliant with ANSI/AAMI DF80.

STAR® Biphasic Waveform – 270J into Pads or paddles

Table A - 270J Waveform into Different Resistive Loads (Typical Values)

Patient's Impedance (Ohms)	Phase 1 Delivered Start Volts	Phase 1 Delivered End Volts	Phase 1 Duration (ms)	Phase 2 Delivered Start Volts	Phase 2 Delivered End Volts	Phase 2 Duration (ms)	Total Energy Delivered (J)
25	1692V	990V	3.25 ms	990V	342V	3.2ms	281J
50	1860V	1234V	4.50 ms	1234V	684V	3.2ms	270J
75	1923V	1338V	5.75ms	1338V	887V	3.2ms	254J
100	1957V	1394V	7.00 ms	1394V	1015V	3.2ms	241J
125	1977V	1429V	8.25ms	1429V	1103V	3.2ms	231J
150	1991V	1453V	9.50 ms	1453V	1166V	3.2ms	223J
175	2002V	1469V	10.75ms	1469V	1214V	3.2ms	217J
180	2003V	1472V	11.00ms	1472V	1222V	3.2ms	216J
200	2009V	1520V	11.00ms	1520V	1283V	3.2ms	202J

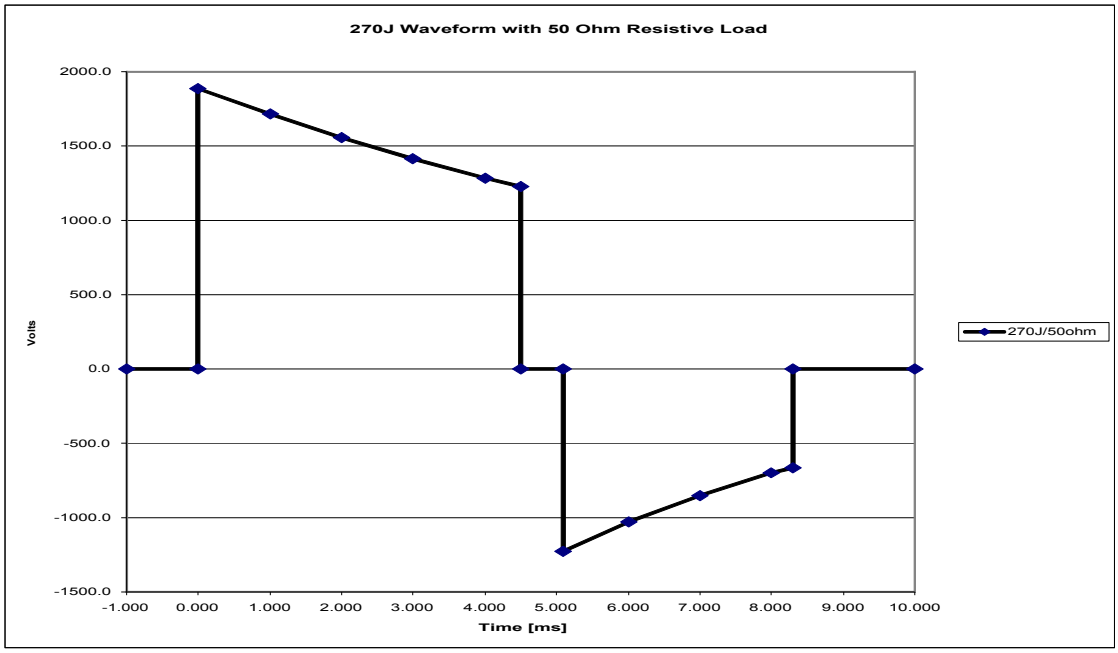
STAR Biphasic Waveform – 50J into internal spoon

Table B – 50J Waveform into Different Resistive Loads (Typical Values)

Patient's Impedance (Ohms)	Phase 1 Delivered Start Volts	Phase 1 Delivered End Volts	Phase 1 Duration (ms)	Phase 2 Delivered Start Volts	Phase 2 Delivered End Volts	Phase 2 Duration (ms)	Total Energy Delivered (J)
10	573V	217V	3.00ms	217V	27V	3.2ms	47J
20	697V	386V	3.00ms	386V	108V	3.2ms	51J
25	728V	426V	3.25 ms	426V	147V	3.2ms	52J
50	800V	531V	4.50 ms	531V	294V	3.2ms	50J
75	828V	576V	5.75ms	576V	382V	3.2ms	47J
100	842V	600V	7.00 ms	600V	437V	3.2ms	45J

Energy Levels and Patient Impedance

The Biphasic Truncated Exponential (BTE) waveform delivers energy that is variant with the patient impedance. The waveform is designed to deliver the selected energy when the patient impedance is 50 Ohms, as shown in the above waveform table.



Safety Standards and Compliance Requirements

The Responder 2000 is designed to meet all applicable requirements of the standards listed below.

IEC 60601-1, (1988 + A1:1991 + A2:1995), Medical Electrical Equipment Part 1 General Requirements for Safety

EN 60601-1, (1990 + A1:1993 + A2:1995), 2nd Edition Medical Electrical Equipment, Part 1: General Requirements for Safety

IEC 60601-1-1, (2000), Medical Electrical Equipment - Part 1: General Requirements for Safety 1: Collateral Standard: Safety Requirements for Medical Electrical Systems

IEC 60601-2-4, (2002), Medical Electrical Equipment – Part 2-4: Particular Requirements for the Safety of Cardiac Defibrillators

IEC 60601-2-49, (2001), Medical Electrical Equipment - Part 2-49: Particular Requirements For The Safety Of Multifunction Patient Monitoring Equipment

IEC 60601-2-27, (1994), Medical electrical equipment, part 2: Particular requirements for the safety of electrocardiographic monitoring equipment

UL 60601-1, (2003), Medical Electrical Equipment Part 1, General Requirements for safety

CAN/CSA-C22.2 No. 601.1-M90, Medical electrical equipment Part 1: General Requirements for Safety

ANSI/AAMI EC-13-2002, Cardiac monitors, heart rate meters, and alarms

ANSI/AAMI DF80-2003, Medical Electrical Equipment – Part 2-4: Particular Requirements for the Safety of Cardiac Defibrillators (including automated external defibrillators)

Electromagnetic Compatibility Requirements

The Responder 2000 meets the requirements of the following EMC standards, as required by IEC 60601-2-4.:

IEC 60601-1-2 (2001), Medical electrical equipment Part 1: General requirements for safety 2. Collateral standard: electromagnetic compatibility - Requirements and tests.

Emissions

Electromagnetic Fields: CISPR 11 (2003), Industrial, scientific and medical (ISM) radio-frequency equipment - radio disturbance characteristics - limits and methods of measurement; Group 1, Class B. IEC 60601-2-4 (2002), Section 36.201.1.

Harmonic distortion: IEC 61000-3-2 (2004), Electromagnetic Compatibility (EMC) Part 3-2: Limits - Limits For Harmonic Current Emissions (Equipment Input Current Less Than Or Equal To 16 A Per Phase).

Voltage fluctuations and flicker: IEC 61000-3-3 (2002), Electromagnetic Compatibility (EMC) - Part 3-3: Limits - Limitation Of Voltage Changes, Voltage Fluctuations And Flicker In public Low-Voltage Supply Systems, For Equipment With Rated Current Less Than Or Equal To 16 A Per Phase.

Immunity

Electromagnetic: IEC 61000-4-3 (2003), Electromagnetic compatibility (EMC) - part 4-3: Testing and measurement techniques - radiated, radio-frequency, electromagnetic field immunity test; Level 3 (10V/m) and X (20V/m). IEC 60601-2-4 (2002) Section 36.202.3.

Magnetic: IEC 61000-4-8 (1994), Electromagnetic compatibility (EMC) - part 4. Testing and measurement techniques - section 8. Power frequency magnetic field immunity test basic EMC publication; Level X (3 A/m). IEC 60601-2-4 (2002), Section 36.202.8.

ESD: IEC 61000-4-2 (2001), Electromagnetic compatibility (EMC) - part 4-2: testing and measurement techniques - electrostatic discharge immunity test; Level 3. IEC 60601-2-4 (2002), Section 36.202.2.

Conducted: IEC 61000-4-6 (2003), Electromagnetic compatibility (EMC) - part 4-6: testing and measurement techniques - immunity to conducted disturbances, induced by radio-frequency fields. IEC 60601-2-4 (2002), Section 36.202.6.

Fast transients and bursts: IEC 61000-4-4 (2001), Electromagnetic compatibility (EMC) - part 4: Testing and measurement techniques - section 4: Electrical fast transient/burst immunity test. IEC 60601-2-4 (2002), Section 36.202.4.

Surges: IEC 61000-4-5 (2001), Electromagnetic compatibility (EMC) - part 4: Testing and measurement techniques - section 5: Surge immunity test. IEC 60601-2-4 (2002), Section 36.202.5.

Voltage dips, short interruptions and voltage variations on power supply input lines: IEC 60601-4-11 (2004), Electromagnetic Compatibility (EMC) - Part 4-11: Testing And Measurement Techniques - Voltage Dips, Short Interruptions And Voltage Variations Immunity Tests.

Environmental Standards

Shock and Vibration

The Responder 2000 is tested per the following when in the unpackaged condition:

Bump: IEC 60068-2-29 (1987), Test EB: bump; 25g, 6 ms, 0.9 m/s ΔV, and 1000 bumps in each direction

Sine Vibration: IEC 60068-2-6 (1995), Environmental testing - part 2. tests - test FC: Vibration (sinusoidal); 0.15mm displacement amplitude, 10-55Hz, 10 sweep cycles in each axis

Random Vibration: IEC 60068-2-64 (1993), Environmental testing - part 2: test methods - test FH: Vibration broadband random (digital control) and guidance: 1-100Hz, 0.01g2/Hz 30 minutes.

Free Fall Drop: IEC 60068-2-32 (1975 + A1:1990), Environmental testing - test methods - test ED: free fall; 18 inches

Enclosure Protection: IEC 60529 (2003), Degrees of protection provided by enclosures (IP code); IP22.

Storage and Shipping

When packaged in the shipping container, the Responder 2000 meets the requirements of:

ISTA Preshipment Test 2A (2001), Simulation Performance Test Procedure - Packaged-Products 150lb(68 kg) or Less

Electromagnetic Emissions Table

Guidance and manufacturer's declaration – electromagnetic emissions		
The Responder 2000 is intended for use in the electromagnetic environment specified below. The customer or the user of the Responder 2000 should assure that it is used in such an environment.		
Emissions test	**Compliance**	**Electromagnetic environment – guidance**
RF emissions CISPR 11	Group 1	The Responder 2000 uses RF energy only for its internal function. Therefore its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The Responder 2000 is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/flicker emissions IEC 61000-3-3	Complies	

Electromagnetic Immunity Table

Guidance and manufacturer's declaration – electromagnetic immunity			
The Responder 2000 is intended for use in the electromagnetic environment specified below. The customer or the user of the Responder 2000 should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines 61000-4-11	<5 % U_T (>95 % dip in U_T) for 0.5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5% U_T (>95% dip in U_T) for 5 sec	<5 % U_T (>95 % dip in U_T) for 0.5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5% U_T (>95% dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the Responder 2000 requires continued operation during power mains interruptions, it is recommended that the Responder 2000 be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE U_T is the a.c. mains voltage prior to application of the test level.			

Guidance and manufacturer's declaration – electromagnetic immunity			
The Responder 2000 is intended for use in the electromagnetic environment specified below. The customer or the user of the Responder 2000 should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
			Portable and mobile RF communications equipment should be used no closer to any part of the Responder 2000, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance**
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz outside ISM bands[a]	3 Vrms	d = 1.2 √P
	10 Vrms 150 kHz to 80 MHz in ISM bands[a]	10 Vrms	d = 1.2 √P
Radiated RF IEC 61000-4-3	10 V/m 80 MHz to 2.5 GHz	10 V/m	d = 1.2 √P 80 MHz to 800 MHz d = 2.3 √P 800 MHz to 2.5 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m)[b]. Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[c] should be less than the compliance level in each frequency range.[d] Interference may occur in the vicinity of equipment marked with the following symbol:
NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies. NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

[a] The ISM (industrial, scientific and medical) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 to 40.70 MHz.

[b] The compliance levels in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz are intended to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas. For this reason, an additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in these frequency ranges.

[c] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the RESPONDER 2000 is used exceeds the applicable RF compliance level above, the RESPONDER 2000 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the RESPONDER 2000.

[d] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 1 V/m.

RF Communications Table

Recommended separation distances between portable and mobile RF communications equipment and the Responder 2000

The RESPONDER 2000 is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the RESPONDER 2000 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the RESPONDER 2000 as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter m			
	150 kHz to 80 MHz outside ISM bands $d = 1.2\sqrt{P}$	150 kHz to 80 MHz in ISM bands $d = 1.2\sqrt{P}$	80 MHz to 800 MHz $d = 1.2\sqrt{P}$	800 MHz to 2.5 GHz $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.12	0.23
0.1	0.38	0.38	0.38	0.73
1	1.2	1.2	1.2	2.3
10	3.8	3.8	3.8	7.3
100	12	12	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be determined using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2 The ISM (industrial, scientific and medical) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 to 40.70 MHz.

NOTE 3 An additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas.

NOTE 4 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Connectors

The following sections describe connectors in the subassemblies within Responder 2000 Defibrillator.

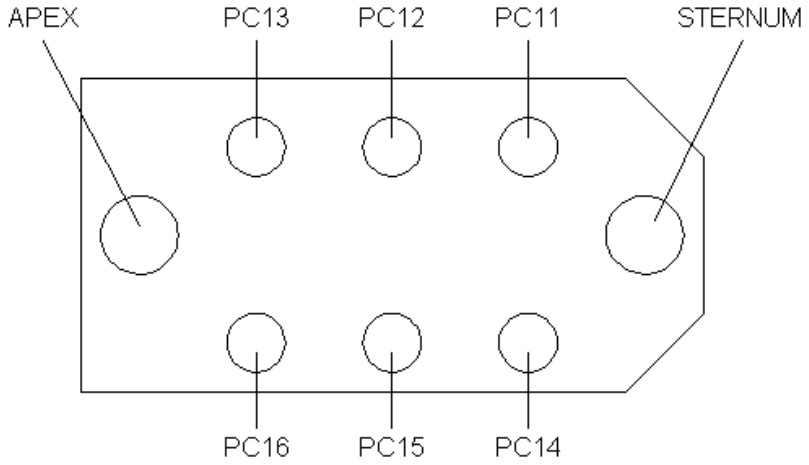
Case

The case serves both as a housing and mechanical structure for the Responder 2000.

Power Connector – IEC 320 type – AC Power

Connector: Heyco 0916		
Pin Number	**Name**	**Description**
1	AC1	AC1 – AC2: 90-264VAC, 47-63Hz, <10A. AC1 or AC2 to GND: <264VAC.
2	AC2	
3	GND	Earth ground connection

Paddles/Pads Connector – GE Defibrillator Paddles



View looking at socket on the back of the Responder 2000

Connector: GE 43252483		
Pin Number	**Name**	**Description**
PC11	SW_CHG/SHCK	Pull Down Input – Charge/Shock Button
PC12	SW_SHCK	Pull Down Input – Shock Button
PC13	N/A	Not Used
PC14	ID_PADS/SPNS	Pull Down Input – ID Bit – Pads

Connector: GE 43252483		
Pin Number	**Name**	**Description**
PC15	RET_PC	Return for Buttons and ID bits
PC16	ID_PDL/SPNS	Pull Down Input – ID Bit – Paddles/Spoons
APEX	SHOCK_P	Patient Apex
STERNUM	SHOCK_M	Patient Sternum

Paddle Connector ID Codes

Cable P/N	Description	PC14	PC16
22338301	Pacer or Defib Pads	Short to PC15	
22334601	Flat Pads	Short to PC15	
21730801	Internal Spoons	4.7K to PC15	Short to PC15
30344625	Responder Paddles		Short to PC15

ECG Connector – GE ECG Connector – Five lead ECG

Connector: GE 401760-1		
Pin Number	**Pin Name**	**Description**
1	RA	Input – Right Arm
2	NC	No Connection
3	NC	No Connection
4	LA	Input – Left Arm
5	RL	Input – Right Leg
6	V	Input – V
7	NC	No Connection

8	LL	Input – Left Leg
9	NC	No Connection
10	NC	No Connection
11	SHLD	Shield

ECG Cable Identification Encoding

ECG Cables available for use with the Cardiac Science Responder 2000 have identification features to enable identification of the cable type. Cable connections are shown here:

Cable Connections for 5 lead, 3 lead and sync cables.				
ECG Connector		**Cable Connections**		
Pin Number	**Pin Name**	**5 Lead Cable**	**3 Lead Cable**	**Sync Cable**
1	RA	RA	RA	- Attenuated Sync Input
2	NC			
3	NC			
4	LA	LA	LA	Center-tap Attenuated Sync Input
5	RL	RL	130M resistor Pin 5 to Pin 6	33M resistor Pin 5 to Pin 6
6	V	V		
7	NC			
8	LL	LL	LL	+ Attenuated Sync Input
9	NC			
10	NC			
11	SHLD	Shield	Shield	

SpO_2 Connector – GE SpO_2

Connector: GE 401762		
Pin Number	**Name**	**Description**
1	SPO2_RCAL	Input – Calibration Data
2	SPO2_LED-	Output – Led Neg
3	SPO2_LED+	Output – Led Pos
5	SPO2_ANODE	Input – Detector Pos
6	GNDF	Isolated Floating Ground
7	SPO2_RCAL_GND	Ground – Calibration Data
9	SPO2_CATHODE	Input – Detector Neg
4, 8, 10, 11	NC	No Connection

Serial Service Connector – DB9-Female

RS232 - DTE. Hardware handshaking not supported.

Connector: Amp 747905-2		
Pin Number	**Name**	**Description**
2	RS232_RxD	Input – RS232 Data
3	RS232_TxD	Output – RS232 Data
5	GND	Ground
1, 4, 6-9	NC	No Connection

Paddle Cradles (Test Load)

Pin Number	Name	Description
RIGHT	Apex	A 50Ohm internal defibrillator test load is connected across the paddle cradles.
LEFT	Sternum	

MAIN CPU PCBA

The main CPU PCBA is the nucleus of the system, with all major subsystems connecting to this board.

J211 - Power Control Interface to Power Control PCBA

AMP 1-103638-3		
Pin Number	**Name**	**Description**
1	NC	Not Used
2	Fan_/Drive	Pull Down Active Fan Drive
3	Serv_DCE_Rx	RS232 Serial input from Service Connector.
4	Serv_DCE_Tx	RS232 Serial Output from Service Connector.
5	SMBUS_CLK	Output – SMBus Serial Clock
6	SMBUS_DATA	Bi-directional – SMBus Data
7	/PWR_ON	Output – Active low control to power switch on the Power Control PCBA.
8,9,10	+12V_SW	Power Input – Power switched on Power Control PCBA
11,12,13	GND	System Ground
14	+12V_UNSW	Power Input – Power always present from Power Control PCBA

J214 – LCD Panel

Hirose FH12-40-S-0.5SH		
Pin Number	**Name**	**Description**
1-4, 6, 31,36	NC	No Connection
5, 10, 14, 18, 22, 26, 30, 32, 34	GND	System Ground
7	LCD_R0	Output - Red Bit 0
8	LCD_R1	Output - Red Bit 1
9	LCD_R2	Output - Red Bit 2
11	LCD_R3	Output - Red Bit 3
12	LCD_R4	Output - Red Bit 4
13	LCD_R5	Output - Red Bit 5
15	LCD_G0	Output – Green Bit 0
16	LCD_G1	Output – Green Bit 1
17	LCD_G2	Output – Green Bit 2
19	LCD_G3	Output – Green Bit 3
20	LCD_G4	Output – Green Bit 4
21	LCD_G5	Output – Green Bit 5
23	LCD_B0	Output - Blue Bit 0
24	LCD_B1	Output - Blue Bit 1
25	LCD_B2	Output - Blue Bit 2
27	LCD_B3	Output - Blue Bit 3
28	LCD_B4	Output - Blue Bit 4
29	LCD_B5	Output - Blue Bit 5
33	LCD_FPSHFT	Output - LCD Pixel Shift

Hirose FH12-40-S-0.5SH		
Pin Number	**Name**	**Description**
35	LCD_DRDY	Output - LCD Frame Shift
37-40	+3.3V	Power Output - LDC Panel Power

J213 – LCD CCFL Backlight

JST SM92B-BHSS-1-TB		
Pin Number	**Name**	**Description**
1	BACKLIGHT1	Power Output – CCFL High Voltage
2	BACKLIGHT2	Power Output – CCFL High Voltage

J218 – UI Interface to Power Control PCBA

(Has UI Functions)

Molex 71226-2425		
Pin Number	**Name**	**Description**
1-2	GND	System Ground
3	/Manual_SW	Pull Down Input Pushbutton – Manual
4	/Spare1_SW	Pull Down Input Pushbutton – Spare1
5	/Shock_SW	Pull Down Input Pushbutton – Shock
6	/Charge_SW	Pull Down Input Pushbutton – Charge
7	CPU_ADC5	Analog Input from UI/PC PCBA Temperature Sensor
8	/Select_SW	Pull Down Input Push-knob – Trim knob Select
9	SQRB	Digital Input – Trim knob phase 2
10	SQRA	Digital Input – Trim knob phase 1
11	/Power_SW	Pull Down Input Pushbutton – Power
12	Power_LED	LED Drive – Pull-Down Output Power LED
13	Spare2_LED	LED Drive – Pull-Down Output Spare2 LED
14	Spare1_LED	LED Drive – Pull-Down Output Spare1 LED
15	Charge_LED	LED Drive – Pull-Down Output Charge LED

Molex 71226-2425		
Pin Number	**Name**	**Description**
16	Manual_LED	LED Drive – Pull-Down Output Manual LED
17	Shock_LED	LED Drive – Pull-Down Output Shock LED
18	Fault_LED	LED Drive – Pull-Up Output Fault LED
19	CHG_IND	Digital Input – Battery Charging
20	AC_IND	Digital Input – AC Present
21	Buzzer	Pull Down Output – 5V Buzzer
22, 23	+5V	Power Output
24	UI_/Present	Pull Down Input – UI PCBA Connected

J216 – SPEAKER

AMP 103638-1		
Pin Number	**Name**	**Description**
1	SPEAKER1	Output – Audio
2	SPEAKER2	Output – Audio

J219 – PRINTER HEAD

Molex 39-51-3263		
Pin Number	**Name**	**Description**
1, 2, 25, 26	+5V_PWR	Power Output – Print head high current supply.
24	+5V_DIG	Power Output – Print head digital supply.
3	CLK	Output – Pixel clock
4	STROBE	Output – Shift Register Latch
5	DIN	Output – Serial Pixel Data
7	OE_0-63	Output – Pixel Burn – Pixels 0-63
8	OE_64-127	Output – Pixel Burn – Pixel 64-127
11	OE_128-191	Output – Pixel Burn – Pixel 128-191
13	THRMSTR	Input – Thermistor (to Ground)
15	OE_192-255	Output – Pixel Burn – Pixel 192-255
17	OE_256-319	Output – Pixel Burn – Pixel 256-319
18	OPTO_COL	Input – Open Collector Active Low paper sense.
20	PAPER_LED	Output – LED Drive – Paper sensor.
22	OE_320-383	Output – Pixel Burn – Pixel 320-383
23	DOUT	Input – Return from end of shift register.

Molex 39-51-3263		
Pin Number	**Name**	**Description**
6, 9, 10, 12, 14, 16, 19, 21	GND	System Ground

J220 – PRINTER MOTOR

JST S6B-PH-K-S		
Pin Number	**Name**	**Description**
1	COIL1A	Output – Motor Coil 1 – Pos
2	COIL1B	Output – Motor Coil 1 – Neg
3	COIL2A	Output – Motor Coil 2 – Pos
4	COIL2B	Output – Motor Coil 2 – Neg
5	DOORSW	Pull Down Input – Door Switch
6	GND	System Ground

J221 – SpO_2 INTERFACE

SAMTEC ESW-107-44-S-D		
Pin Number	**Name**	**Description**
8	RxD	Output - Isolated Logic Level Serial
9	TxD	Input - Isolated Logic Level Serial
10, 13	+5V	Isolated Power Output
2, 3, 5, 11, 12, 14	GND	Isolated Ground
1, 4, 6, 7	NC	No Connection

J210 – THERAPY PCBA

MOLEX 52610-2090		
Pin Number	**Name**	**Description**
1	THRP_/PRSNT	Pull Down Input – Therapy PCBA plugged in
2	THRP_HVEN	Output – HV enable
3	THRP_/SHOCK	Output – Shock enable (active low)
4	THRP_ISOPWRON	Output – Therapy isolated power enable
5	THRP_Rx	Input – Logic Level Serial
6	THRP_Tx	Output – Logic Level Serial
7	+3.3V	Power Output
8	GND	System Ground
9	PDL_ID_PC5	Pull Down Input – Paddle ID bit
10	PDL_ID_PC4	Pull Down Input – Paddle ID bit
11	PDL_CHGSHCK	Pull Down Input – Button – Charge/Shock
12	PDL_SHCK	Pull Down Input – Button – Shock
13	PDL_ID_PC6	Pull Down Input – Paddle ID bit
14, 15	PDL_GND	System Ground
16-19	NC	No Connection
20	THP_PRSNT_GND	Grounded output to Therapy – Looped back on THRP_/PRSNT

J212 – ECG PCBA

SAMTEC DW-04-11-F-D-500		
Pin Number	**Name**	**Description**
2	TxD	Output - Logic Level Serial
4	RxD	Input - Logic Level Serial

SAMTEC DW-04-11-F-D-500		
Pin Number	**Name**	**Description**
6	/ECG_EN	Output – Active Low ECG power enable
7, 8	+12V	Power Output
1, 3, 5	GND	System Ground

THERAPY PCBA

The therapy PCBA provides defibrillation, pacing, and ECG amplification and digitization from the therapy electrodes. All operations are performed per serial communications with the main CPU PCBA. The **Therapy Board** also serves as a pass through board for controls and ID features on defibrillator paddles.

J103 - Power Supply

Connects to power management PCBA

Molex 39-30-2047		
Pin Number	**Name**	**Description**
2, 3	+12V_SW	Power Input – Switched on Power Management PCBA.
1, 4	GND	System Ground

J110 – Main CPU PCBA interface

Molex 52610-2090		
Pin Number	**Name**	**Description**
1	THRP_/PRSNT	Pull Down Input – Therapy PCBA plugged in
2	THRP_HVEN	Output – HV enable
3	THRP_/SHOCK	Output – Shock enable (active low)
4	THRP_ISOPWRON	Output – Therapy isolated power enable
5	THRP_Rx	Input – Logic Level Serial
6	THRP_Tx	Output – Logic Level Serial
7	+3.3V	Power Output

Molex 52610-2090		
Pin Number	**Name**	**Description**
8	GND	System Ground
9	PDL_ID_PC5	Pull Down Input – Paddle ID bit
10	PDL_ID_PC4	Pull Down Input – Paddle ID bit
11	PDL_CHGSHCK	Pull Down Input – Button – Charge/Shock
12	PDL_SHCK	Pull Down Input – Button – Shock
13	PDL_ID_PC6	Pull Down Input – Paddle ID bit
14, 15	PDL_GND	System Ground
16-19	NC	No Connection
20	THP_PRSNT_GND	Grounded output to Therapy – Looped back on THRP_/PRSNT

J109 – Paddles Control Connector

AMP 103670-7		
Pin Number	**Name**	**Description**
8	PDL_CHGSHCK	Pull Down Input – Button – Charge/Shock
7	PDL_SHCK	Pull Down Input – Button – Shock
6	PDL_ID_PC6	Pull Down Input – Paddle ID bit
5	PDL_ID_PC4	Pull Down Input – Paddle ID bit
3	PDL_ID_PC5	Pull Down Input – Paddle ID bit
1, 2, 4	PDL_GND	Paddle Control Ground – Isolated from Patient

J101, J102, J108 – Paddles HV Connectors

Keystone 1287-ST		
Pin Number	**Name**	**Description**
J101	PDLHV_STERN	Patient Connection – Sternum

J102	PDLHV_APEX	Patient Connection – Apex

J104, J105, J106, J107 – Energy Storage Capacitor Connectors

Keystone 1287-ST		
Pin Number	**Name**	**Description**
J104	HVCAP1_POS	Energy Storage Capacitor 1 – Pos
J105	HVCAP1_NEG	Energy Storage Capacitor 1 – Neg
J106	HVCAP2_POS	Energy Storage Capacitor 2 – Pos
J107	HVCAP2_NEG	Energy Storage Capacitor 2 – Neg

J126, J127 – Internal Test Load Resistor

Keystone 1287-ST		
Pin Number	**Name**	**Description**
J126	TESTLOAD1	Connects to a paddle cradle
J127	TESTLOAD2	Connects to a paddle cradle

ECG PCBA

The ECG PCBA is a monitoring ECG subsystem. All operations are performed per serial communications with the main CPU PCBA.

J412 – Interface to main CPU PCBA

Power and serial communications are carried through this connector.

SAMTEC BCS-104-L-D-PE-BE		
Pin Number	**Name**	**Description**
1	GND	System Ground
2	SER_CPU2ECG	Logic Level Serial Data Input
3	GND	System Ground
4	SER_ECG2CPU	Logic Level Serial Data Input
5	GND	System Ground

6	/ECG_EN	ECG Isolated power enable
7	+12V	System +12V (nominal)
8	+12V	System +12V (nominal)

J423 – Patient ECG Connection

Keystone 4903		
Pin Number	**Name**	**Description**
J4231	RA	Electrode - Right Arm
J4232	LA	Electrode - Left Arm
J4233	LL	Electrode - Left Leg
J4234	V1	Electrode - V1
J4235	RL	Electrode - Right Leg
J4236	SHLD	Cable Shield

POWER CONTROL PCBA

Responsible for battery charging and DC power switching and distribution. Also includes UI functions

J315 – Power input from DC power supply

Molex 39-30-3058		
Pin Number	**Name**	**Description**
1	GND	System Ground
2	GND	System Ground
3	GND	System Ground
4	+12V_MAIN	Power Input
5	+12V_MAIN	Power Input

J325 – Smart Battery Connector – Data and Power

Suyin 250137MR010G101ZU

Pin Number	Name	Description
1, 2, 3, 4	GND	System Ground
5	BAT_TEMP	Input – 10K to Ground
6	SMBUS_DATA	Bi-directional – SMBus Data
7	SMBUS_CLK	Bi-directional – SMBus Serial Clock
8, 9, 10	+12V_BAT	Battery Positive

J303 – Therapy power

Molex 39-30-3047		
Pin Number	**Name**	**Description**
1	GND	System Ground
2	+12V_SW	Power Output
3	+12V_SW	Power Output
4	GND	System Ground

J311 – Power Control interface from main CPU PCBA

AMP 1-103673-3		
Pin Number	**Name**	**Description**
1	+12V_UNSW	Power Output – Power always present.
2, 3, 4	GND	System Ground
5, 6, 7	+12V_SW	Power Output – Power switched on Power Control PCBA
8	/PWR_ON	Input – Active low control to power switch on the Power Control PCBA.
9	SMB_DAT	Bi-directional – SMBus Data
10	SMB_CLK	Input – SMBus Serial Clock
11	SERV_TX	Service Port Tx RS232 Data From Main PCBA

12	SERV_RX	Service Port Rx RS232 Data To Main PCBA
13	/FAN_DRV	Fan Drive – Pulled Down ON Passes through Power Control PCBA to J232
14	N/C	

J318 – UI Features - Interface to main CPU PCBA

Molex 52207-2490		
Pin Number	**Name**	**Description**
1	UI_/Present	Grounded Output (UI PCBA Connected)
2, 3	+5V	Power Input
4	Buzzer	Pull Down Input – 5V Buzzer
5	AC_IND	Digital Output – AC Present
6	CHG_IND	Digital Output – Battery Charging
7	Fault_LED	LED Drive – Fault LED Pull-Down Input from Main PCBA
8	Shock_LED	LED Drive – Shock LED Pull-Down Input from Main PCBA
9	Manual_LED	LED Drive – Manual LED Pull-Down Input from Main PCBA
10	Charge_LED	LED Drive – Charge LED Pull-Down Input from Main PCBA
11	Reserved	Reserved for: LED Drive – Spare1 LED
12	Reserved	Reserved for: LED Drive – Spare2 LED
13	Power_LED	LED Drive – Power LED Pull-Down Input from Main PCBA

Molex 52207-2490		
Pin Number	**Name**	**Description**
14	/Power_SW	Pull Down Output to Main PCBA Pushbutton – Power
15	SQRA	Digital Output to Main PCBA Trim knob phase 1
16	SQRB	Digital Output to Main PCBA Trim knob phase 2
17	/Select_SW	Pull Down Output to Main PCBA Push-knob – Trim knob Select
18	CPU_ADC5	Analog Output to Main PCBA Temperature Sensor
19	/Charge_SW	Pull Down Output to Main PCBA Pushbutton – Charge
20	/Shock_SW	Pull Down Output to Main PCBA Pushbutton – Shock
21	Reserved	Reserved for: Pushbutton – Spare1
22	/Manual_SW	Pull Down Output to Main PCBA Pushbutton – Manual
23, 24	GND	System Ground

J317 – RS-232 SERIAL SERVICE INTERFACE

AMP 103673-2		
Pin Number	**Name**	**Description**
1	Tx	RS232 Output
2	Rx	RS232 Input
3	GND	System / Serial Ground

J323 – FAN

AMP 103673-1		
Pin Number	**Name**	**Description**
1	+12V	Power Output
2	/FAN_OUT	Pull Down Output – Fan

J324 – ENCODER "Trim Knob"

AMP 0-215079-6		
Pin Number	**Name**	**Description**
1,2	GND	System Ground
3	/Select_SW	Pull-down switch input
4	SQRB	Digital Input from encoder Trim knob phase 2
5	SQRA	Digital Input from encoder Trim knob phase 1
6	+5VDC	Power Output

SpO_2 PCBA – GE506 Module mounts on the main CPU PCBA with interfacing header connectors plugged directly together with no cable.

J2 - SpO_2 HOST INTERFACE

Samtec FTSH-107-01-L-D-RA		
Pin Number	**Name**	**Description**
8	RxD	Output – Logic level serial
9	TxD	Input – Logic level serial
11	CTS	Input – Tied low on Main CPU PCBA
10, 13	+5V	80mA
2, 3, 5, 12, 14	GND	Power and Signal Ground Return
1, 4, 6, 7	NC	

SpO_2 PATIENT INTERFACE

Samtec FTSH-105-01-L-D-RA		
Pin Number	**Name**	**Description**
1	DET+	Input – Detector Pos
2	DIGICAL_GND	Ground – Calibration Data
3	DIGICAL_DAT	Input – Calibration Data
4	DET-	Input – Detector Neg
5	SHLD_INNER	Inner Shield
6	N/C	No Connection
7	LED-	Output – Led Neg
8	N/C	No Connection
9	LED+	Output – Led Pos
10	SHLD_OUTER	Outer Shield

POWER SUPPLY MODULE

Provides DC power for the instrument via the Power Control PCBA.

TB1 – POWER INPUT

Heyco 0916 – Wire connected - Mounts on back of instrument		
Pin Number	**Name**	**Description**
1	L	AC Input 90-264VAC 47-63Hz
2	G	
3	N	

POWER OUTPUT

Wire Connected – Plugs into Power Control PCBA		
Pin Number	**Name**	**Description**
1	GND	NOMINALLY 13.5V

2	GND	POWER OUTPUT IS FLOATING WITH RESPECT TO: EARTH GROUND POWER INPUTS
3	GND	
4	+12V	
5	+12V	

BATTERY

Provides DC power for the instrument via the Power Control PCBA while the instrument is not plugged into an AC power source.

J325 – Smart Battery Connector – Data and Power

Suyin 250132FB010G200ZU		
Pin Number	**Name**	**Description**
1, 2, 3, 4	GND	Battery Ground
5	BAT_TEMP	Output – 10K to Ground
6	SMBUS_DATA	Bi-directional – SMBus Data
7	SMBUS_CLK	Bi-directional – SMBus Serial Clock
8, 9, 10	+12V_BAT	Battery Positive

Contact Information/Customer Service

To order supplies or accessories, contact your representative or distributor. For technical support, contact your local GE customer service.
Please have the serial and model numbers available. The serial and model numbers are located on the back of the Responder 2000.

Responder 2000 is manufactured for:

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Responder™ 2000

defibrillator/monitor